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THE MARINE REVIEW

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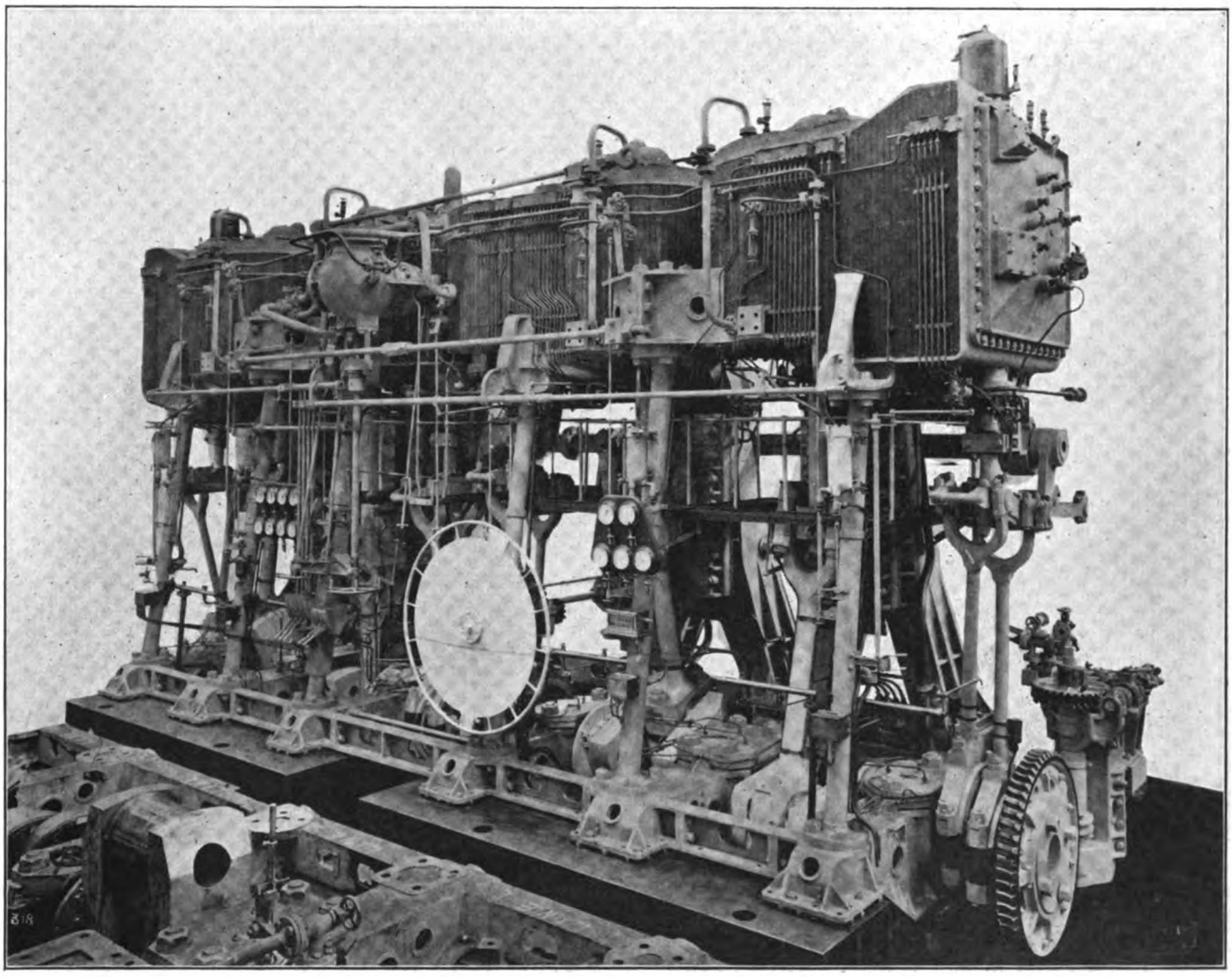
ENGINES OF BATTLESHIP.

The propelling machinery of the new Japanese battleship Katori, built and engined by Messrs. Vickers Sons & Maxim, Barrow-in-Furness, consist of two sets of four-cylinder triple-expansion engines balanced on the Yarrow-Schlick-Tweedy system, designed to give 16,000 I. H. P., each set having one high, one intermediate, and two low-pressure cylinders. The diameters of the cylinders are respectively 35½ in., 56 in., and 63, for each of the low-pressure cylinders, with a stroke of 48 in. The steam pressure at the boilers is 230 lbs. per square inch. Stephenson's link motion is adopted for working the valves, which are of the piston type on the high pressure and intermediate cylinders, and of the double-ported flat design on the low-pressure cylinders. The engines are designed to turn the propellers inwards when going ahead, so that the starting platform is in the center of the ship; wrought steel columns from the supports of the cylinders, which are independent castings, and the back supports are of the ordinary cast iron "A" framing, with ample slipper guide surface. The condensers, which are four in number, are placed in the wings of the ship. The total cooling surface



ENGINES OF THE JAPANESE BATTLESHIP KATORI.

Built by Vickers Sons & Maxim, Barrow-in-Furness.

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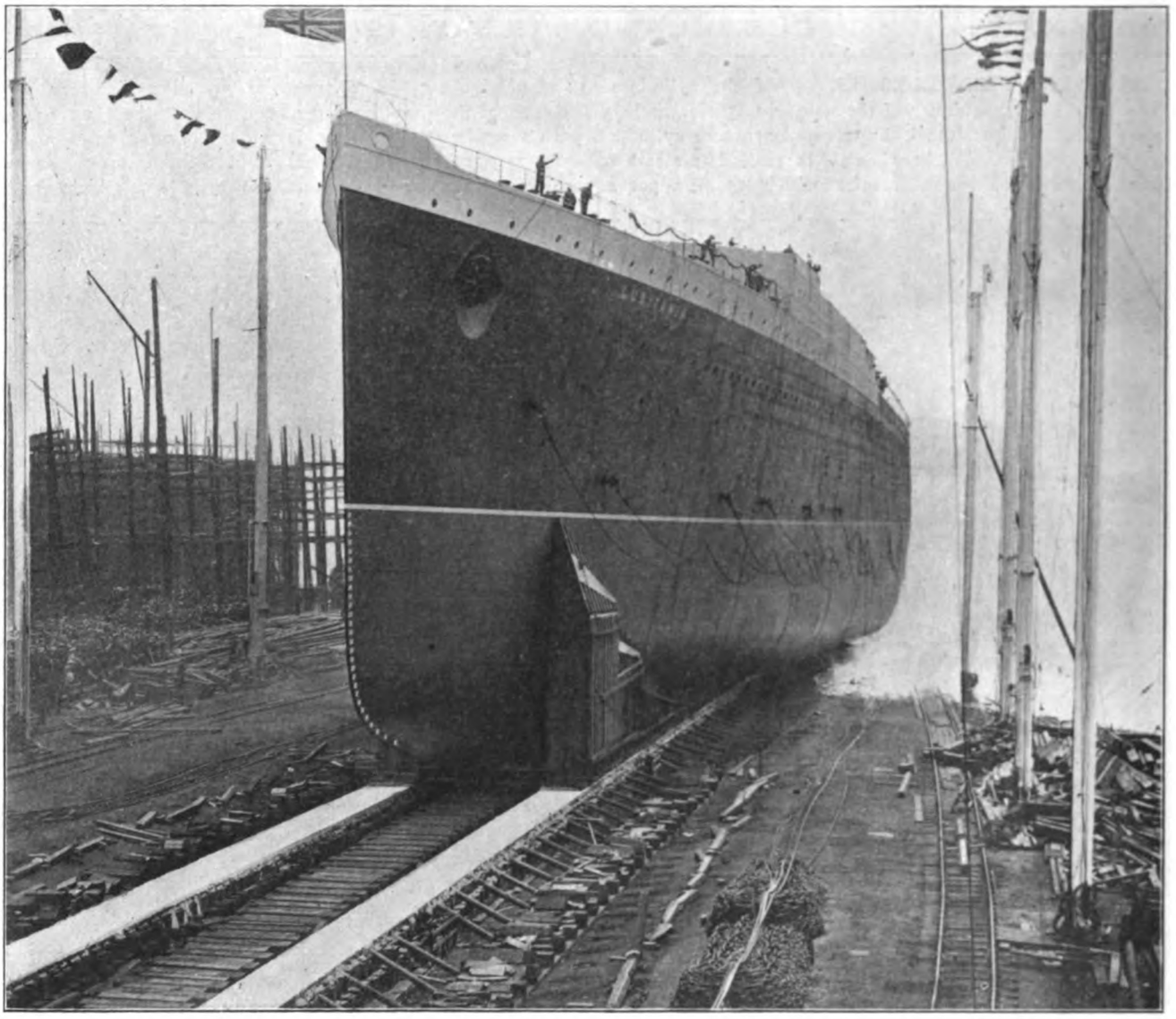
is 17,000 sq. ft., each crank shaft is in two interchangeable pieces, and the propeller shaft is 18 in. in diameter with a 10-in. hole, while the propellers have four blades, the diameter being 17 ft. 3 in. The blades and the boss are of Stone's bronze. The boilers are of the latest Niclausse type, twenty in number, five with 16 sections, and fifteen with 15 sections, each section consisting of 24 tubes. The total heating surface is 44,000 sq. ft., and the total grate area 1,334 sq. ft. Her trials developed a mean speed of 20.22 knots, the engines making 130 revolutions per minute.

THE NEW TURBINE CUNARDERS.

As already announced in the MARINE REVIEW, the Lusitania, the largest ship the world has yet seen was safely launched on the Clyde on June 7 by Messrs. John Brown & Co. The importance of the event was made the most of on the Clyde notwithstanding that launches there are almost a daily occurrence. For two years past the attention of everybody interested in shipping has been focused on the pair of express steamers building for the Cunard line. The reason for this is three-fold. First, the vessels will be the largest in the world; secondly, it is the intention of the owners and builders that they shall be the fastest in the world; and thirdly, the turbine system of propulsion will be adopted instead of the reciprocating engines with which, up to the present, the fastest ocean steamers have been equipped. The builders entrusted with one of these ships, the most important task which ship builders, British or foreign, have been asked to perform are Messrs. John Brown & Co., Ltd., of Clydebank, and in their work the builders of the Lusitania have been assisted by the valuable experience gained in the construction of those wonderful ocean hotels, the Caronia, (propelled by reciprocating engines), and Carmania (turbine), vessels which though young in service have already won world-wide popularity for their design, their steadiness and the general comfort and excellence of their passenger accommodation. The mere mention of dimensions conveys but a vague idea of the size of the Lusitania. The official figures are as follows: Length, 790 ft.; breadth, 88 ft.; depth molded, 60 ft.; gross tonnage, 32,500 tons; displacement tonnage, 45,000



LAUNCHING OF THE CUNARD TURBINE FLYER LUSITANIA.

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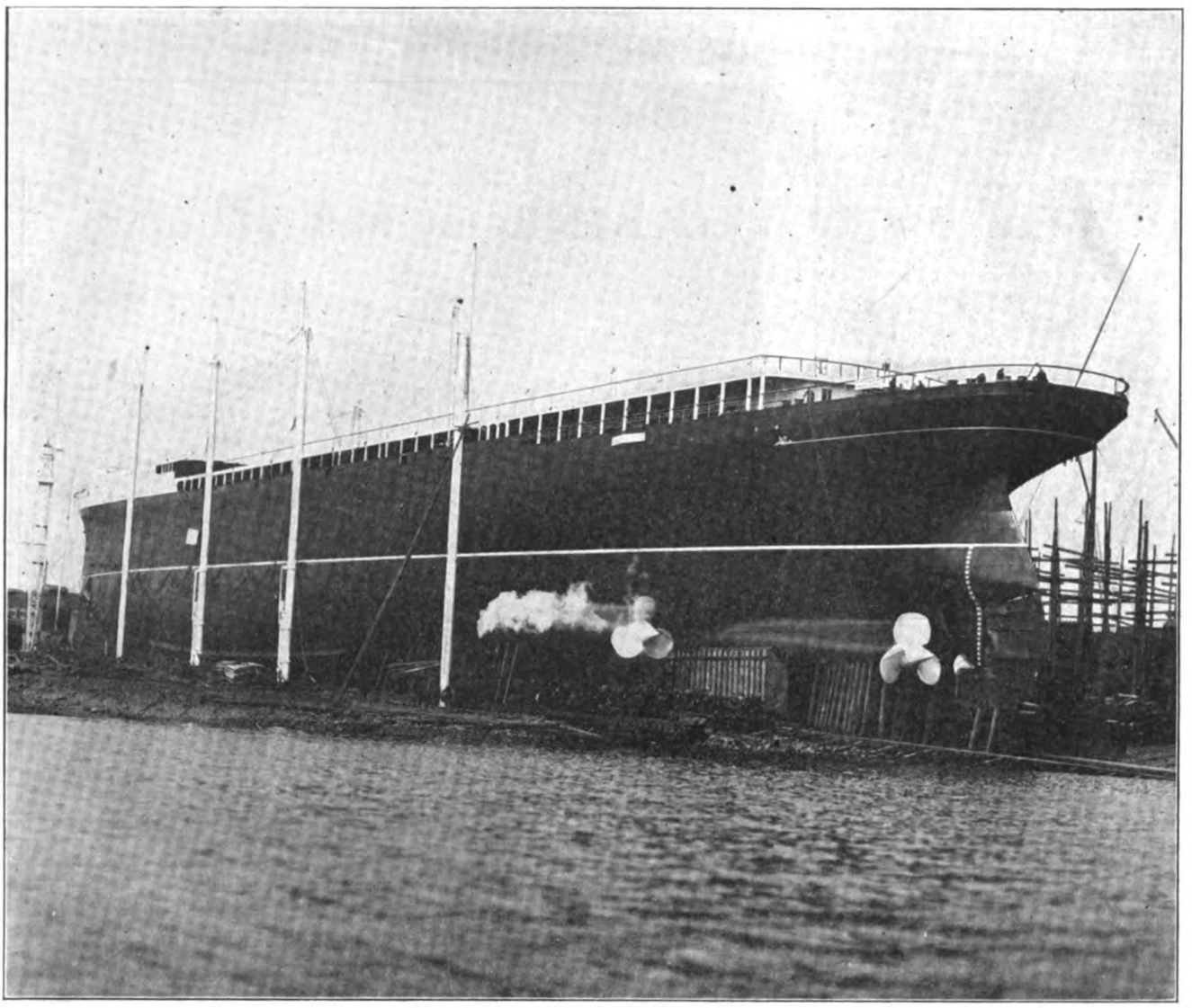

STERN VIEW OF THE LUSITANIA, SHOWING TWO OF HER FOUR PROPELLERS.

tons; load draught, 37 ft. 6 in.; height of funnels, 155 ft.; diameter of funnels, 24 ft.; and height of masts, 216 ft. One of the longest trains made up in the British islands is the Cunard "special" which runs between Buston, London and the Riverside station, alongside the Liverpool landing stage. The train, however, with its powerful engine and tender, its two brake vans, two dining cars and eight coaches, is about 100 ft. shorter than the Lusitania. As the ship lay on the ways prior to launching, she was the dominant feature in the landscape. The hull of the Lusitania as she glided down the ways into the Clyde was over 16,000 tons, a figure which exceeds all previous launching weights. By the time she is completed in engine, boiler and passenger accommodation, this weight will have increased almost 100 per cent, while ready for sea with water in her boilers, her stores aboard, and her 7,000-ton bunkers filled, her weight without cargo will be approximately 45,000 tons. In the modern ship the first structural work after the keelplate is laid is the double bottom. The keelplate of the Lusitania is five feet wide and 3¾ in. thick, and is flush outside with the bottom of the ship. Associated with this flat keel is a vertical keel five feet high and one inch thick, and to this vertebra are attached directly or indirectly the frames and beams which make up the skeleton of the leviathan. The double bottom is divided by a vertical keel five feet high and transverse frames, into compartments in which water ballast may be carried. The tops of these tanks are carried well round the turn of the bilge, so that should the bilge keels be torn away and the hull pierced, the entering water would be confined between the inner and outer bottoms. This is only one precaution in the direction of securing unsinkability. The lower decks are made comparatively watertight, and in all there are 175 watertight compartments, the doors of which can be closed automatically from the navigating bridge in a few seconds, so that it may be claimed for her that she is as unsinkable as a ship can be. The steel plates which cover the ribs or framing of the vessel, or are used for the decks, bulkheads and casings number 26,000, the largest being about 40 ft. in length, and weighing from four to five tons. To secure these plates to each other and the structural framework of the ship, over 4,000,000 rivets have been used aggregating in weight about 500 tons. The largest rivets were used in the keelplate, and these are eight inches in length, and weigh 2¾ lbs. The main frames and beams placed end to end would extend 30 miles; the rudder which has two sets of steering gear, one of which is below the water line, weighs 65 tons, and the diameter of the rudder stock is 26 in. The castings for the stem, stern post, shaft bracket and rudder together weigh 280 tons. Her ground gear is the strong-

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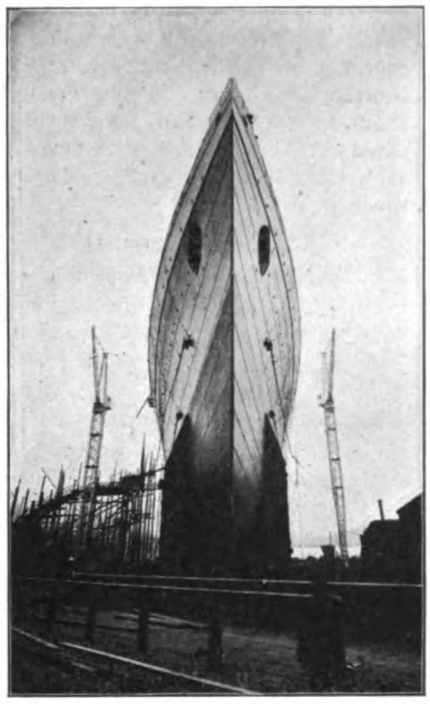
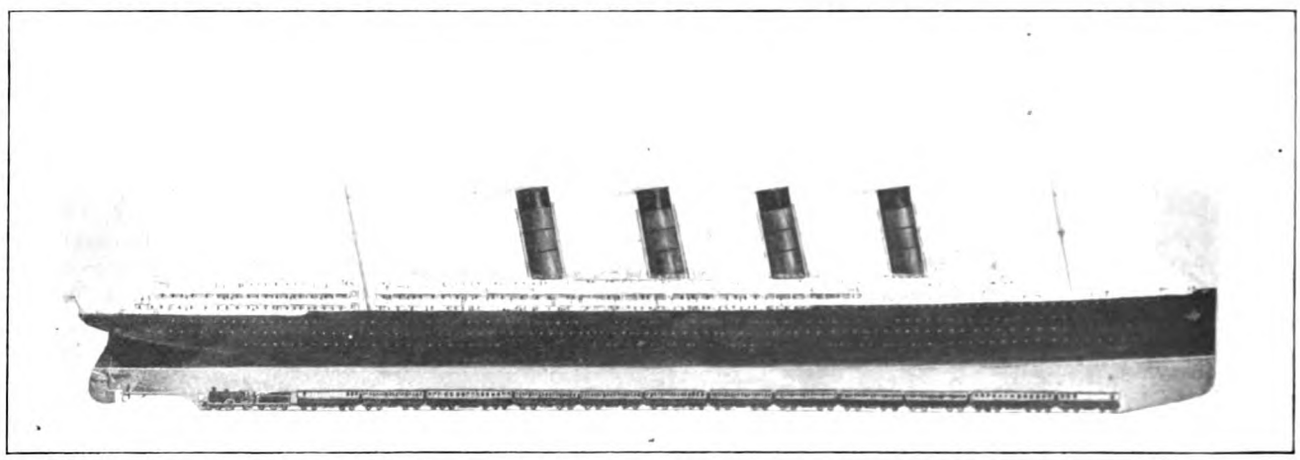
est yet made, as befits the work of holding the 45,000-ton leviathan at rest



BOW VIEW OF THE LUSITANIA.

in a swiftly flowing tidal stream like the Mersey. The three anchors each weigh ten tons, while the 1,800 ft. of cable is composed of 22-in. links, the iron in which is 3¾ in. in diameter, and the weight of each link about 1½ cwts. Every portion of this harness has been vigorously tested, the links and shackles emerging successfully, from a test strain of 370 tons. There are nine decks on the ship including the hold. The size of the ship and especially the height between decks, which is 10½ ft., will ensure in the passenger quarters a spaciousness which those who travel by the vessel are bound to appreciate, for this will be at least 50 per cent greater than in preceding Atlantic liners. In addition to the dining saloon there will be an a la carte restaurant and a verandal cafe. A notable feature will be the provision of two passenger lifts. There will be telephones in the staterooms, and telephonic communication between different parts of the ship, bridge, engine room, crow's nest, and the rooms of the principals, whether navigational, engineering or administrative. The Lusitania complies with the British admiralty requirements as an armed cruiser, and will be fitted for an armament of twelve six-in. guns. These guns represent her offensive powers. With the view of protection, her rud-

THE LUSITANIA ON THE STOCKS.



THE CUNARDER LUSITANIA COMPARED WITH A CUNARD EXPRESS TRAIN.

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der and one set of steering gear are below the water line, and in the way of the engine and boiler rooms there are side bunkers, which, filled with coal or water, will be equivalent to an armor belt round the vulnerable portion of the ship.

The following interesting table shows at a glance the progress made by the Cunard company in connection with the speed dimensions and accommodation of their various vessels, as time has proceeded, the enormous advance of the Lusitania on the Campania being particularly noticeable.

Another table of exceedingly great interest is one which shows in juxtaposition the dimensions and other particulars concerning the Lusitania, the Campania, and the Kaiser Wilhelm II, the last mentioned boat having temporarily wrested the supremacy of the Atlantic from the Campania only to be herself outmatched by the great Cunard flyers:

	Britannia, 1840.	Persia, 1856.	Gallia, 1879.	Umbria, 1884.	Campania, 1893.	Lusitania, 1906.
Coal necessary to steam to New York (tons)	570	1,400	836	1,900	2,900	5,000
Cargo carried (tons)	224	750	1,700	1,000	1,620	1,500
Passengers	115	250	320	1,255	1,700	2,350
Indicated horsepower	710	3,600	5,000	14,500	30,000	68,000
Steam pressure (lb.)	9	33	75	110	165	200
Coal per indicated horsepower per hour (lb.)	5.1	3.8	1.9	1.9	1.5	1.45
Speed (knots)	8.5	13.1	15½	19	22	25

NAME OF SHIP.	Lusitania.	Campania.	Kaiser Wilhelm II.
Length over all	785 ft.	622 ft.	706 ft. 6 in.
Breadth molded	88 ft.	65 ft. 3 in.	72¼ ft.
Depth molded	60 ft. 6 in.	41 ft. 6 in.	52½ ft.
Gross tonnage	32,500 tons	12,500 tons	20,000 tons
Draught	33 ft.	25 ft.	29 ft.
Displacement	38,000 tons	18,000 tons	26,000 tons
No. of passengers—first	550	600	775
No. of passengers—second	500	400	343
No. of passengers—third	1,300	700	770
Type of engine	Turbine	Reciprocating.	Reciprocating.
Total i. h. p.	68,000	30,000	38,000 to 40,000
Speed	25 knots	22 knots	23½ knots

Engineering in the course of a long description of the Cunard liner Lusitania, says that the ship is the largest yet constructed, alike in length, draught and displacement; but this is not due so much to requirements for high speed as to the need for providing extensive accommodation to ensure satisfactory revenue, in order, as far as possible, to meet the expense of the great speed. The proposal has often been made that first-class passengers should only be carried on high-speed Atlantic liners, as it would not then be so necessary to build such very large ships. This, of course, would somewhat reduce the power for a given speed. The case of the torpedo boat destroyer is quoted; but destroyers have limited fuel capacity; the Atlantic liner has to carry coal to maintain her maximum speed for a voyage of 3,000 miles across the Atlantic. This itself is a very heavy load, and there is involved a great increase in size and in weight of constructional material, which again necessitates great power. The importance of making a ship of very fine lines, and consequently of securing the least possible coefficient of fineness, calls for length as well as great beam; and thus, notwithstanding the continuous aim on all hands to economize the size of the ship, each increment in speed has involved a great advance in size. The 20-knot Atlantic liner of twenty years ago had a displacement of 10,500 tons; the 22-knot ship of ten years ago was 18,000 tons; the 23-knot ship of five years ago, 23,000 tons; and now to reach 25 knots it has been found necessary to raise the displacement weight to 38,000 tons. The dominant factor in this great increase of displacement is the great addition to engine power for a comparatively slight increase in speed. Thus, twenty years ago the ratio of power to displacement for a 20-knot speed was 1.35 to 1; for 22 knots ten years ago, 1.66 to 1; and today for 25 knots, it is 1.8 to 1. Thus, for an advance in speed in twenty years equal to 25 per cent, the power has increased from 14,000 to 68,000, or nearly five-fold. It is true that with increased economy the coal consumption per unit of power is considerably less—25 per cent—but notwithstanding the less time taken on the voyage, owing to increased speed from Liverpool to New York, the total tonnage of coal has gone up from 1,900 to 5,000 tons. The table appended is instructive from this point of view. It shows the reduction in consumption per unit of power per hour, due largely to the increase in steam pressure; but it indicates also a very steady advance in the power necessary to obtain the increase in speed. Since the first Cunarder was built, sixty-five years ago, the speed has been multiplied only three-fold, but the power has had to be increased nearly a hundred-fold. Owing, however, to the higher economy, and the shorter time taken on the voyage—about four and a half days, as compared with fifteen days—the coal consumption for the voyage is only ten times greater.

LUSITANIA'S TURBINES.

In the course of an exceedingly interesting description of the engines of the Lusitania, the engineering correspondent of the Glasgow *Herald* gives the following particulars:

The machinery, however, is after all the most important feature in the vessel. As already indicated, there are four shafts, each driving an independent propeller. On the two-wing shafts there are the high-pressure turbines taking steam direct from the boilers. After the steam has passed through these, driving the long series of rings of blades, connected to the shaft, it passes to the low-pressure turbines mounted on the inner shafts, does similar work in them, and ultimately passes into the condensers. On the inner shafts there are large turbines for driving the ship astern. Thus there are six turbines—four for ahead and two for astern motion. In the construction of the turbines the first operation consisted in forging the shafts, and the rotor drums to be mounted on the shafts. These forgings, of great weight and strength, were made at the Atlas works of the company at Sheffield. Simultaneously there were cast the casings which enclose the rotors, with their thousands of blades, for utilizing the velocity of the steam to give the shaft its rotary motion. These casings are also massive pieces of work, a fact which will be appreciated when it is stated that the rotor casing and blades of the low-pressure turbines of the ship weigh about 450 tons. While the rotor is in one piece, the casing requires to be in halves, the one for the lower part of the circumference and the other for the upper. Both are ultimately bolted together to form a complete circle. Around the rotor grooves were turned into which the actuating blades were secured; while on the inner surface of the casing there were similar grooves formed for the fixed blades to guide the steam against the moving blades on the rotor. The work of turning the rotors and casing required to be most precise, because there will only be something like one-twentieth part of an inch between the tips of the rotating blades and the

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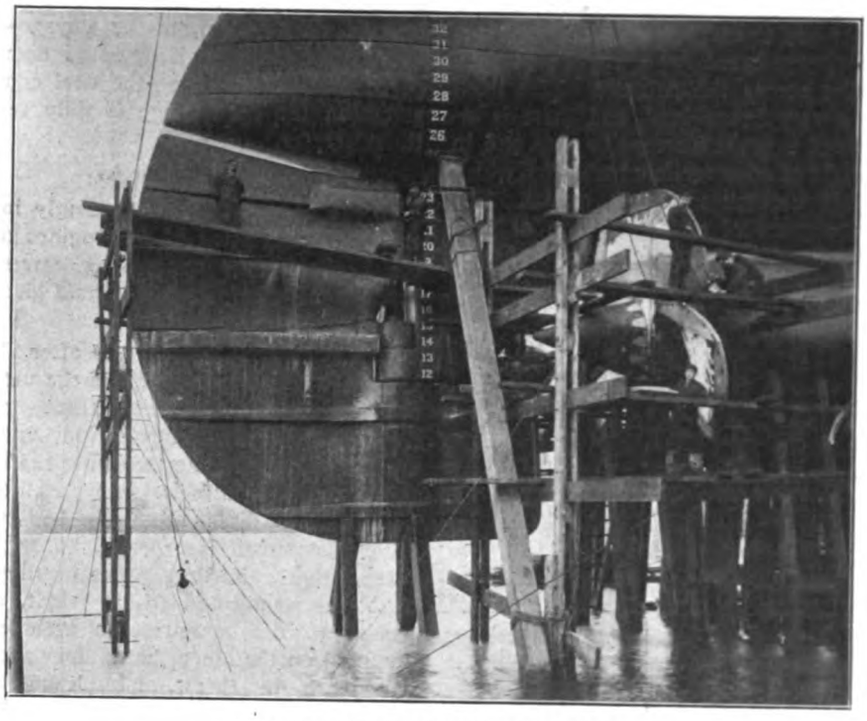
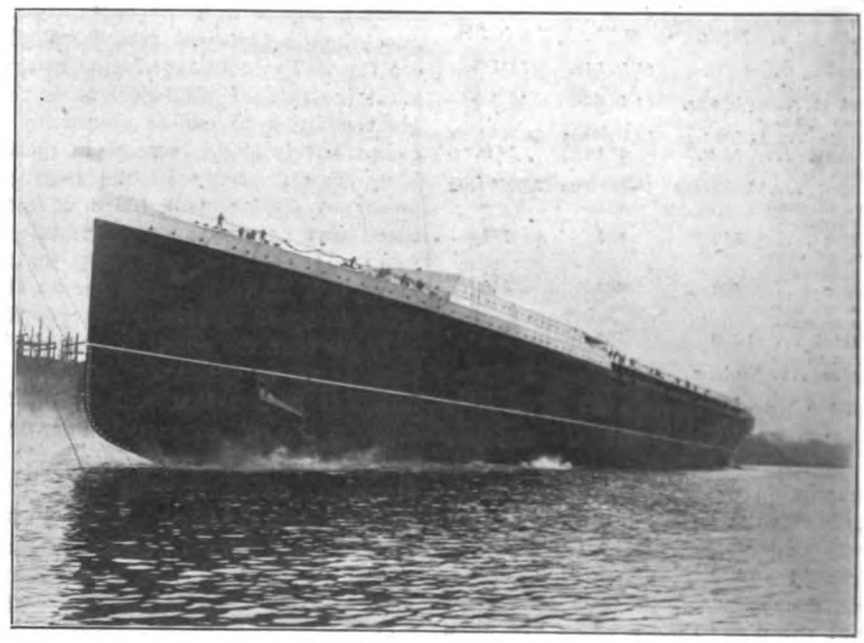
surface of the casing, and a similar clearance between the fixed blades on the casing and the surface of the rotor. It will, of course, be understood that the rows of blades in rotor or casing alternate, and when it is remembered that the speed at the periphery of the circle formed by the blades on the rotor ranges from 100 to nearly 150 ft. per second, an idea can be formed of the importance of ensuring that there will be no contact between the moving blades and adjoining surface. Otherwise the friction involved would result in such heating as to fuse the blades or to result in their being stripped from their grooves. On the other hand, it is equally important that there should be the minimum space between the blades and the neighboring surfaces, otherwise steam would escape without doing any useful work.



IMMENSE RUDDER OF THE LUSITANIA.

THE BLADES OF THE TURBINES.

The blades are of brass, and their lengths increase from the point where the steam from the boiler enters the turbine to the last row of blades, where the steam, having "spent" itself, passes to the condenser. The steam expands continually, and at each row of blades there is probably a drop in pressure equal to nearly one pound per square inch. Theoretically each successive row of blades should be larger than that immediately preceding in order that the best efficiency may be got with expansion, but it is found in practice sufficient to make five or six rows of the same length, and in large turbines there are eight or nine such groups, which successively are of blades of increased length. The length of the blade is dependent on the initial steam pressure and the speed of rotation. With fast-running turbines used for driving electric dynamos, where the revolutions may be anything over a thousand a minute, they are very small; but in large ships like the Lusitania, where there are great advantages in having the propellers as large as possible and in running them at low speed it is necessary to minimize the number of revolutions. Consequently in the Lusitania the turbine blades have reached their maximum length so far, being over 20 in. at the low-pressure end of the low-pressure turbine. The blades of brass were wedged into the grooves formed on the rotor and casing, and are thus at right angles to the surface. The blades in each ring are equidistant from each other, but to accommodate expansion the distance between each ring increases with their length, so that near the condenser this interval, separating the rings, attains its greatest width. The edges of the grooves were serrated with saw teeth, so that the blades might be the more effectually wedged in. The blades projecting present on their edge approximately the form of a half of the letter U considerably thickened in the center. They are bound together by a brass wire square or tape, which fits into square indents made on the back edge on each blade near the top. This wire is laced with a copper round wire, and the whole is soldered with silver solder. This binding strengthens the long blades, and in some cases there are several such blades in the length of the blade. After the blades were put into their grooves in their rotor or casing, and finally secured and bound together, the complete unit was put into a lathe in the case of the rotor or a boring machine for the casing, to ensure that there would not be a greater deviation in length than about one-thousandth part of an inch, as equal length is absolutely essential in view of the small clearance between the blades and the surface past which they rotate.



THE LUSITANIA TAKING THE WATER.

POINTS DEMANDING CARE.

It is important, too, that the blades should be in perfect alignment because

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of the small distance between the edges of the fixed and moving blades. In the larger blades there is a length of edge of quite 20 in. working at a great speed past a corresponding length of fixed blades, and it will be readily understood that the slightest tendency to rubbing would be disastrous. Indeed, this is one of the causes of the trouble experienced in one or two ships. The steam, it will be understood, as it enters the turbine is guided by a ring of conveniently set blades to flow into the cavity formed by the blade which takes the line of a half U, and this steam exerts a driving force against the blade, turns the shaft, and escapes past the back edge of the blade into the space beyond. There it enters among the second ring of fixed blades, which similarly guide it against the second ring of moving blades, and so to the end of the long series in the turbine. Were the clearance between the edges of the fixed and moving blades greater there would be leakage of steam without effective work being done, and thus it will be recognized that most careful design and workmanship was necessary. There are other equally significant points upon which great care has been bestowed at Clydebank. A method of gland-packing has been devised to prevent the escape of steam at the end of the turbines. A system has been perfected for taking up the expansion so that there would be greater exactitude in the clearance between the blades and in the distance between the edges of the blades.

OTHER FACTORS IN EFFICIENCY.

Other factors in the efficiency have reference to the longitudinal adjusting of the rotor within the casing. This also determines the distance between the edges of the moving and fixed blades. With that marvelous completeness which marked his great invention, Mr. Parsons devised a system consisting of a "finger plate" secured to the fixed frame of the turbine which indicates on the rotor shaft the exact clearance permissible, so that the engineer can tell at a glance whether the rotor is in its exact position in relation to the fixed blades in the casing. Screws are provided so that adjustments can be made in the relative position longitudinally of the rotor and casing; but as a rule when the turbine has been once well and truly fitted into its casing no change need be made. For the same reasons it is important that the rotor should keep a true level in its bearings, and any tendency of the rotor to sag within the turbine is recorded. For this there is fitted a vertical point at the end of the casing immediately over the shaft, and by this any change, even of a thousandth part of an inch, in level of the rotor or shaft can be detected. The rotor, too, must be absolutely balanced circumferentially. To test this it is, when completed, mounted on a well-founded and truly level trestle with knife edges. The massive rotor, weighing in many cases over 100 tons, moves easily; if not, the part of its circumference requiring alteration by the addition or subtraction of weight is detected and rectified. Many other similar regulating details might be referred to as a proof of the necessity of precise workmanship, and to show also that the conditions have been amply realized at Clydebank, but the instances quoted may suffice. The construction of such immense masses to such fine margins of exactitude as thousandths of an inch is indeed gratifying proof of the efficiency of the British workman.

THE ENGINE ROOM AND RACING.

In a letter to the New York *Times*, Capt. Mahan, U. S. N., stated that when returning from Europe the steamer on board of which he was a passenger narrowly escaped colliding, during a fog in mid-ocean, with another floating palace. Capt. Mahan thought fit to explain also that he deemed it the duty of passengers to make public all instances of this nature, in view of the fact that the prominent steamship companies have their respective "lanes" from which none of their ships is supposed to wander.

There is also an order prohibiting racing between these ocean liners, Thus, of course, when lately the largest German steamship was scheduled to leave New York at the same time as the largest French rival every official of each line was emphatic in denials of any intention to permit racing on this occasion. However that may be, the talent declared the German the favorite—on the water front dope sheets she was offered at 3 to 5. But this optimistic prophecy on the German side was only guess work—the Frenchman got under the wire first, and then the Deutschland's captain came out with the statement that the Provence cut across lots and thus gained 100 miles; in other words, the Frenchman had wandered from that straight and narrow path prescribed by the managers of the line.

Again, however also that may be, the German engineers blamed the peculiarly inferior quality of coal with which their bunkers had been filled for the unsatisfactory outcome of the contest. Those to whom all coals, like coons, look alike may regard this as an opportune time for reminding the German protestants of the old adage, "anyone wishing to beat a dog can easily find a stick."

All engineers, however, will readily agree that the quality of the coal is of the utmost importance in such a case. In engineering colleges the pupils are taught the selection of good coal; are shown samples of different grades. Also, the maximum percentage of waste—ashes and clinkers—coal may leave after burning without being pronounced of inferior quality from this autopsy of the remains. A good engineer, a man who gets the maximum result from the minimum amount of coal, does not believe that to see to it that his engines make the required number of revolutions is the only important duty he has to perform.

It must not for a moment be thought that these reputed wealthy trans-Atlantic steamship lines give their engineers "carte-blanche" in the matter of coal, and even oil, consumption.

Numerous parts of the engine are automatically lubricated, but other parts again must be "oiled by hand."

And the oiler when coming on watch receives his allowance, that is, enough oil is poured into his tank—of which he alone has the key—to enable him to lubricate all parts for which he is responsible during one watch—4 hours.

In case of a hot bearing he must needs ask for an extra allowance, which, in some instances, is in the nature of asking for a black mark against his ability as an oiler.

In such a case it is for the engineer to decide whether retarding the speed of the engine or only extra lubricating is necessary.

Last summer the cross-head slides on a New York excursion boat became overheated. The engineer decided to "keep her going" and presently they had to disconnect the connecting rod from the crankpin—to enable the wheel to revolve while towing—for the cross-head broke.

But to come back to the case of the two huge steamers.

The log book should tell if the Frenchman had made use of his own particular "lane."

And if the Deutschland had bad coal—and we have the verdict of a man who should know all about it—she made an uncommonly good showing, creditable to the firemen and especially to the chief.

The De La Vergne Machine Co., Ft. E. 138th street, New York city, who are the sole licensees for the manufacture of the Koerting gas engine and producer in the United States, have just issued a ten page folder describing the Koerting four-cycle gas engine and suction producer. These engines have met with remarkable success in Europe where a large number have been installed in municipal lighting plants, factories and other places.

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VICTORY IS IN SIGHT.

Although the first session of the 59th congress has passed into history without having among its list of "things accomplished" the enactment of the shipping bill, nevertheless, the situation of that bill is one that justifies the most emphatic statement that its passage through the house of representatives early in the coming short session, and its final enactment, may be looked for before the Christmas holidays. Of course, on the 5th of July the Christmas holidays look a long way off, and they are.

Just a little more than two years ago the congressional Merchant Marine Commission, composed of five senators and five representatives, who had been appointed in deference to President Roosevelt's urgent suggestion, began its public hearings on the subject of the merchant marine of the United States. It held public hearings in many of the leading Atlantic, Pacific, Gulf and lake ports, receiving information and suggestions from as many citizens as could be persuaded to appear before them—all as to how our shipping in the foreign trade could best be restored. The record of those hearings, and the report of that commission, occupy about 2,000 pages. They were presented to congress in January of 1905, too late for action in the closing days of the 58th congress, although the bill which the commission drafted, for the purpose of carrying into effect their recommendations, had been promptly and favorably reported to both the senate and house of representatives by the committee on commerce and the committee on merchant marine and fisheries, respectively.

The bill was promptly reintroduced at the opening of the first session of the 59th congress, just closed. The commission had been continued during the interim by special act of congress, and it made a new report at the opening of the recent session, but with little or no change in the bill as originally presented. It may be well, at this time, to briefly sketch the main features of the bill, in the form in which it passed the senate on February 14, 1906. Senate bill No. 529 provides:

1. A volunteer naval reserve of 10,000 officers and men of the merchant marine and fisheries, trained in gunnery, etc., subject to the call of the president in war, and receiving retainer bounties as 33,500 British naval reserve men do.

2. Subventions at the rate of five dollars a gross ton a year to all cargo vessels in the foreign trade of the United States, and to craft of the deep sea fisheries, and $6.50 a ton to vessels engaged in our Philippine commerce—the Philippine coastwise law being postponed till 1909. But these cargo vessels in order to receive subventions must be held at the disposal of the government in war, must convey the mails free of charge, be seaworthy and efficient, carry a certain proportion of Americans and naval reserve men in their crews, and make all ordinary repairs in the United States. Ships lose their subventions if they leave our trade for that of foreign countries, or if, like the Standard Oil craft, they are not engaged exclusively as common carriers.

3. Subventions to new mail lines from the Atlantic coast to Brazil, Argentina and South Africa; from the south Atlantic coast to Cuba; from the Gulf coast to Cuba, Brazil, Mexico, Central America and the Isthmus of Panama; from the Pacific coast via Hawaii to Japan, China and the Philippines, and to Mexico, Central America and the Isthmus of Panama and from the north Pacific coast direct to Japan, China and the Philippines with increased compensation to one existing contract line from the Pacific coast via Hawaii and Samoa to Australasia.

All ships receiving subventions must be already American by register or American-built—thus excluding the foreign-built fleet of the Atlantic Steamship Combination. Not one dollar is given to fast passenger and mail lines to Europe. Ships constructed for foreign commerce to receive these subventions can under the Dingley tariff be built, equipped and repaired of materials imported free of duty.

The maximum annual cost of the proposed mail subventions will be about $3,000,000; of the other subventions and retainers to the naval reserve, from $1,550,000 in 1907, to $5,750,000 in 1916. If tonnage taxes are increased, as originally proposed, the legislation will cost nothing the first year, but turn $616,000 into the treasury, and the annual average net cost for ten years, with the building of new ships, will be $4,625,000.

Great Britain next year will pay $6,000,000 or $[illegible] in shipping subsidies, France $[illegible], Italy $[illegible], and Japan about $4,[illegible].

This bill now rests in the committee on merchant marine and fisheries, of the house of representatives.

The bill has been carefully studied by President Roosevelt, who has, to a large and representative delegation of the League members, stated that it is a skillfully drawn bill, a desirable bill, and one that he is doing his utmost to have passed. The Merchant Marine League of the United States, long antedating the assembling of the 59th congress, had been hard at work in bringing to the attention of the people, through the press and through commercial, financial, industrial and labor organizations, and directly to the attention of senators and representatives in congress, the need of, and the benefits that would result from, the enactment of this measure. The result of the work of the Merchant Marine League has been to convince that portion of the American press that is not implacably hostile to any form of protective legislation that the measure is moderate and meritorious, and that it would be effective in restoring a large and efficient American merchant marine to the foreign carrying trade. The hostile press comments are, nowadays, few and far between, and are almost wholly confined to free trade newspapers. Besides this, the leading commercial organizations of the country have, in some cases several times, specifically indorsed the shipping bill, and asked for its enactment at the hands of congress. Other organizations, including financial, industrial and labor associations have done likewise. These indorsements are by national, state and local organizations, and they come from the south, the north, the west and the east, showing that the demand for this legislation is wholly national, non-sectional and widespread. In addition to this, largely as a result of the work of the League, influential individuals, in different parts of the country, have personally brought the subject directly to the attention of their senators and representatives.

The League will address itself, in the remaining five months, to further efforts along the educational lines in which it has been so active, so that, when the second (the short) session of the 59th con-

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gress meets, in December of this year, every representative in congress will realize, in unmistakable terms, that the country needs, for the purposes of national safety and commercial expansion, a great fleet of American built, American-owned, American-officered and manned ships in the foreign trade.

So much has been said, in the press and privately, of the opposition of Speaker Cannon, that we are gratified to be able to state, upon the assurances of the League's officers, that this is incorrect. It is expected that in the short session Speaker Cannon will make it clear to all men that he warmly favors a great American merchant marine in the foreign trade, and that he most heartily approves of the legislation that will secure it.

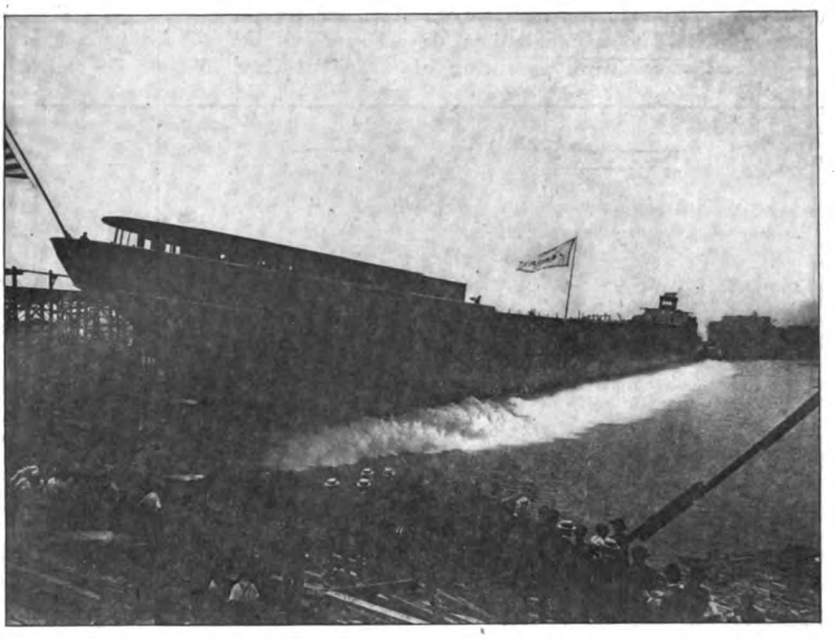
Not the least important development in this connection is the statement published two weeks ago in the MARINE REVIEW, prepared by the Merchant Marine League, showing that, as soon as the pending shipping bill passes, orders will be placed in Atlantic coast ship yards for no less than 75 new steamships, for the foreign trade. These ships will aggregate about 400,000 tons, will cost about $40,000,000, and will increase the present efficiency of our foreign-going marine more than fifty per cent. It will mean the inauguration of an enduring American merchant marine policy that will eventuate in a foreign-going shipping equal to all the needs of our foreign commerce, round out and complete the development of our great national industries, make of us one of the leading maritime powers, and make us strong in the only place that we are now weak—upon the seas.

CONTRACT FOR ANOTHER STEAMER.

Capt. C. W. Elphicke, of Chicago, closed a contract with the Great Lakes Engineering Works, of Detroit, for a freight steamer of moderate size. In general dimensions she will resemble the steamers W. G. Pollock and Joshua Rhodes, built by the American Ship Building Co. for Mr. W. H. Becker, of Cleveland. The new steamer will be 440 ft. over all, 420 ft. keel, 52 ft. beam and 28 ft. deep. Her hatches will be spaced 24 ft. centers and will extend 12 ft. fore and aft. Her engines will be triple-expansion, supplied with steam from two Scotch boilers. Passenger quarters will be ample and will include an observation room.

LAUNCHING OF THE STEAMER J. Q. RIDDLE.

The steamer J. Q. Riddle, building for the Milwaukee Steamship Co., Capt. Arthur H. Hawgood, of Cleveland, manager, was launched at the Lorain yard of the American Ship Building Co. on Saturday last. She could have been launched some minutes earlier, as the launching party arrived at 11:40, but the ship yard superintendent desired her held until high noon. The launching was clean in every respect, the steamer taking the water upon an even keel. Mrs. Ida R. Pennington named her in honor of her father. The launching party were later entertained at luncheon at the Clifton Club by the ship building company. Mr. Harry Vail presided as toastmaster.



LAUNCHING THE STEAMER J. Q. RIDDLE.

He introduced as the first speaker Mr. J. Q. Riddle. Mr. Riddle regretted that he had not the consolation of Daniel, who upon being thrown into the lion's den and surveying his company exclaimed: "Well, at any rate, I shall not be called upon to make an after dinner speech." Mr. Riddle did not think that too many ships were being built for the lake trade. He held that the wants of the people are increasing in greater ratio than ever before; that the country is expanding at a rate that the people little dream of, and that there is ample trade on the lakes for existing tonnage.

This point of view was endorsed by Mr. James C. Wallace, who was the next speaker. Mr. Wallace thought that lake commerce has only started and that the new tonnage constructed during the year was not much greater than the wastage caused by the elements among the older vessels. He predicted that a dearth of boats would be experienced next fall, as a movement of 38,000,000 tons of ore is expected and the movement to date this year is not appreciably greater than that of last year. Touching the exhaustion of the ore deposits in the Lake Superior country he said that when the Steel Corporation was formed 900,000,000 tons were proved up and that since then 900,000,000 more had been proved.

Capt. Arthur Hawgood declared the Riddle to be a masterpiece of the greatest ship builder on earth, and that while she was a Riddle she would by no means be a puzzle to her owners.

Mr. Sheldon Parks was introduced by the toastmaster as one of the buttresses of the church, that is to say, supported from the outside. Mr. Parks complimented the Hawgoods upon the progress which they have lately made as vessel managers, increasing their fleet of steel steamers from one in 1901 to fourteen in 1906. He also paid tribute to the wit, wisdom and judgment of Mr. Riddle.

Judge Harold Remington made a few remarks emphasizing the desirability of vessel stock as a security. Brief concluding remarks were made by Mr. Parker Shackleton, Mr. Sam Scoville, Mr. P. W. Ditto.

The Riddle is 552 ft. over all, 532 ft. keel, 56 ft. beam and 31 ft. deep. She has 32 hatches, spaced 12 ft. centers. Her engines are triple expansion, with cylinders 23½, 38 and 63 in. cylinder diameters by 42-in. stroke, supplied with steam from two Scotch boilers, 14 ft. 6 in. by 11 ft. 6 in., equipped with Ellis & Eaves draft and allowed 180 lbs. pressure. She will be ready for commission in about thirty days and will be sailed by Capt. C. M. Saph. Her engineer will be George Smith.

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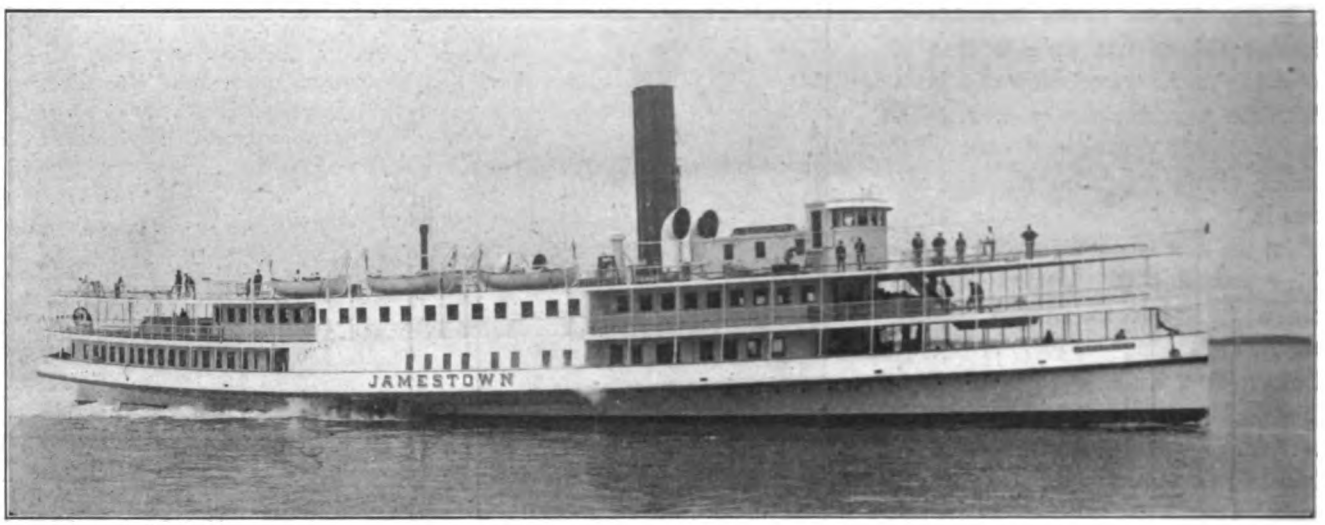
PASSENGER STEAMER JAMESTOWN.

The side-wheel passenger steamer Jamestown, built at Newport News, Va., by the Newport News Ship Building & Dry Dock Co. for the Norfolk & Washington Steamboat Co., was delivered to her owners at their wharf in Washington on June 20. The Jamestown represents a new departure in ship building. She is the first fire proof vessel ever built in this or any other country. In her construction the use of inflammable material was reduced to an infinitesimal degree, the only woodwork consisting of window frames, doors and furniture. Having in mind the frightful Slocum disaster, the designers strove to make the Jamestown absolutely proof against fire and in this, it is thought, they have been successful.

This new steamer, which will accommodate 2,800 passengers, is intended for day service on the Norfolk & Washington Steamboat Co.'s line and will ply between Washington and Norfolk, touching at Fortress Monroe (Old Point Comfort). At this time no day steamer is operated between these points, and it was to meet this demand and to be prepared for the increased passenger traffic incident to the Jamestown Exposition, which is to be held on Hampton Roads in 1907, that the Norfolk & Washington Steamboat Co. determined to put on a day steamer to be operated in connection with its night line. With the Jamestown in commission the line has a fleet of six modern steamers.

An average speed of 18 miles an hour was specified in the contract, and this the Jamestown had no trouble in maintaining during her trial run made near the Virginia capes on June 18. The steamer was sent over a 13-mile course laid off between Thimble Light and Cape Henry Light, making a run each way. On the run toward Cape Henry Light she covered the distance at the rate of 19.93 miles. With an adverse wind and strong tide she steamed back over her course at a good margin over 18 miles, making her average for the two runs 19.2 miles. Among those on board during the trial run were Capt. John Callahan, second vice president and general manager of the Norfolk & Western Steamboat Co., who conceived the idea of building a fireproof passenger steamer, and Mr. Walter A. Post, general manager of the Newport News Ship Building & Dry Dock Co. The ship was in command of Capt. William G. Melvin.



PASSENGER STEAMER JAMESTOWN.

The principal dimensions of the Jamestown are as follows:

Length over all .....262 ft.
Length from after side of stem to forward side of rudder post ....250 ft.
Beam over guards ..... 63 ft.
Beam molded, at water line .....38 ft.
Depth molded ..... 14 ft. 6 in.
Draught ..... 8 ft. forward, 9 ft. aft.

The Jamestown has three complete decks, with partial lower deck forward and aft of the machinery space. On the main deck aft is fitted a large dining room, with a private dining room in the after end of the main dining room. Forward of the dining room is located the main lobby, with a stairway leading to the upper cabin. The bar is situated on the lower deck forward. On the main deck abreast of the machinery casings are fitted the men's toilet, the barber shop and purser's office on the port side, and a parcel room and three private parlors on the starboard side. In the enclosed space forward of the stairway to the upper cabin on the main deck is located a lunch counter. A woman's parlor, two private parlors, four staterooms and toilet rooms for men and women are fitted on the saloon deck. Open stairways are provided forward and aft for access to the shade deck, where are located the pilot house and officers' quarters.

The vessel is of steel construction. All houses and bulkheads are steel-built, and the interior of the dining room, cabins, private parlors and staterooms are finished with No. 24 U. S. S. gauge steel ceiling cork, painted on side adjacent to house plating. The divisional bulkhead throughout between the rooms is corrugated. The main deck forward, the bar, toilet rooms, dining rooms, purser's office and main deck in lobby and opposite passenger gangways are covered with rubber tiling. The deck in all quarters, in passages on the main deck, the upper cabins and private parlors are covered with heavy linoleum, while the saloon and shade decks, where exposed, are covered with canvas and light asbestos tiling. Under the main deck over the engine, boilers and galleys fireproof composite board is fitted. The underside of the saloon and shade decks are sheathed with light steel. The furnishings of the saloons and rooms consist of wicker couches and chairs, upholstered in fabrikoid.

The Jamestown was built to meet all applicable requirements of the rules of the U. S. inspection service, the quality of all material being in accordance with the rules of the American Bureau of Shipping.

The propelling machinery consists of four return-tube Scotch type boilers and one inclined direct-acting compound engine with cylinders 30 in. by 64 in. in diameter and 66 in. stroke for all pistons. In all its parts the engine is proportioned for a working pressure of 150 lbs. and 50 r. p. m. The wheels are of feathering type, 16 ft. in diameter, with 9 buckets 9 ft. long and 2 ft. 9 in. wide. There is one single smokestack about 64 ft. above grate level, with 7 ft. inside diameter.

Being modern in construction and equipped with the latest appliances, the Jamestown will be one of the finest steamers in Virginia waters.

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THE ENGINE ROOM OF THE ORIENT.

In Erie basin a "sky-sail yard" bark, the Adam W. Spies, is being transformed, or transrigged into a fore-and-aft schooner. And as Capt. Hines, her commander, looked up at the naked, former giants of some Oregon forest, he gave it as his opinion that "it was enough to break a whale's heart." However that may be, whatever sense there may be in judging the fragility of a whale's heart on an Oregon pine basis, certain it is that the now schooner Adam W. Spies has advanced one step toward that stage of her career when she must depend entirely on steam for her means of propulsion. In other words, a few years hence her present rig will be again changed to a rig that is known in the vernacular as "bald-headed"; one, perhaps two, of her after masts will be removed, and the former sky-sail yarder will follow, at the end of a line, some now (by her commander) much despised steamer—a tow barge.

All the foregoing is simply a straw that shows the wind's direction; similar incidents, and they happen daily, are indicative of the trend of the age. And this is only another manner of saying that the grimy chap with oil can is more and more replacing the picturesque tar with the marlinspike. For instance, last summer two deckhands deserted from the steamer that carries the mail from Sag Harbor to New London. But the mail arrived on time just the same, for a deckhand on a steamer is deemed of as little consequence as is the constitution between some friends. When, however, a few days later two firemen failed to make their appearance at the time of sailing, there was a most awkward interference with the United States' mails, a skurrying of gold-braided officials, and a sigh of relief when at last the two husky, but decidedly grimy, firemen, reported ready for their strenuous duty. But, however hard may be the lot of the fireman, whatever may be said as to the importance of pilot and captain, the most exacting position on board a steamer is certainly held by the engineer.

The steamer above referred to, the Orient, is scheduled to leave Sag Harbor at 6:20 a. m. Hours before that time the watchman has called a fireman to "set back" the fires which were "banked" during the night. And of all the crew only the fireman and the engineer are preparing for the day's work. The former, as said before, is getting up steam, while the latter, after seeing to it that the boiler carries a "full-glass" of water, proceeds to "test" the nuts, and they are numerous, of the sidewheels. At 6 a. m., the oiler commences his greasy work; he goes in places where passengers fear to tread; they (the places) are too dirty, too hot, too dangerous.

At 6:05 the pilot gives three long blasts on the whistle to intimate to prospective passengers that the Orient, flying the United States mail flag, will be ready to leave her dock in fifteen minutes. And while the dock frequenters gaze up with reverence at the pilot house where a with-gold-upholstered pilot manages to make a frightful noise by simply pulling a string, the engineer gives his opinion of this part of the day's performance—"20 lbs. of steam." The pilot then shifts the rudder from board to board to make sure that it is in good working order. But the Orient is not a "handgrinder"; the oiler has already attended to the needs of the steam steering engine, which, of all places, has been installed in the forecastle.

Another steam consumer, the donkey pump, which has been used to wash the decks, is now stopped. In comes the gangplank, off go the lines, and "two bells", the order to go astern, is heard in the engine room. This is a one-cylinder, horizontal engine. It is of a type, built by Fletcher, of Hoboken, not provided with double eccentrics; or, in order to make it clear to the lay mind, when "backing" the engineer must move the slide valve by hand.

A 7-foot, beautifully polished steel bar is now inserted in the socket, and by watching the position of the solitary crank which denotes the position of the piston in the cylinder, the engineer, by moving the bar up or down, permits steam to enter either in the after or in the forward part of the cylinder. "Full speed astern"—the long bar is being moved swiftly by an engineer who has only eyes for the revolving crank; the after spring line, which is still fast to the dock, causes the ship's head to describe a semi-circle—then, one bell, and the bar comes to a rest, said rest being coincident with the stopping of the cranks, and thus the paddlewheels' revolutions. A short, an almost ridiculously short, blast of the whistle means "Haul in that stern line." Then one bell, as an intimation to the engineer to go ahead, and again that tiresome, monotonous up and down motion with that bar; this time, however, so manipulated that the crank revolves in the opposite direction from the one when "two bells" had been sounded.

Now she is on her course; the "jingle bell" tells this to the engineer, and the latter, by a process which in the vernacular is known as "dropping the hooks," makes Mr. Fletcher's eccentrics move the slide valve automatically. This obviates the need of the polished steel bar, which is then placed in a nearby rack—off duty at present; useless when the ship is going at full speed ahead, but still decidedly ornamental.

Breakfast. The assistant engineer now takes charge. The pilot remains at the wheel, and the captain, the "Chief", the purser and the mate are going to investigate what the steward has been able to provide for the fifty cents which the company allows per day for each member of the crew.

During meal time the captain and purser monopolize the conversation. With the exception of the "Chief" it is not deemed good form for any others, be they mate, baggage master or what not, to express any opinion—unless requested to do so. The "Chief" is listening intently; not, however, to the views expressed by captain or purser, but to various sounds, intelligible only to him, emanating from his hard laboring patient—the engine. A clattering noise makes him half rise from his chair. A fireman rapping with a slice bar against an iron bulkhead, which in engine room parlance means "stop the ash pump," was the noise which the chief interpreted as the cylinder's complaint that the boiler was priming. Boiling over, or "priming," often results in the steam carrying water into the cylinder. At the end of a stroke, when the piston is at the extreme end of the cylinder, there remains little room for water between the piston and cylinder head. A rapping noise indicates the presence of water, much water means a cracked cylinder head, and this puts the engine entirely out of commission, interferes with the mails, and—but the ash pump has been stopped.

Through "Plum Gut"; a short stop at the North dock (at a time when a strong northeaster blows, land at the South dock)—again comes the manipulation of that long steel bar; "drop the hooks" and away for New London; Bartlett reef lightship, at the mouth of the river Thames, being plainly visible to those who know in what direction to look for it. A westerly wind, causing a list to starboard, brings the chief out of the engine room with a request to have some barrels rolled over to port.

"Keep her on a level keel; we cannot meet that train on time with only the starboard wheel churning the water."

Three long blasts and one short are heard from somewhere off the port

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beam. It is the lightship's manner of asking "How do you do?" And the Orient's three long and two short blasts answer plainly (to those versed in nautical grammar), "Thank you, very well." "An ocean of steam lost for some needless civility," is the chief's comment of the remarks "en passant."

9:30 a. m., arrived at the New London dock on time; hurry up and clean the fires. And while passengers come on board, baggage is stowed, automobiles and carriages wheeled on the 'tweendecks. The firemen are "cleaning the fires." In fact, it appears as if they are pulling out every bit of burning material they can possibly reach. "Hot" is hardly the correct name for it. Again the fires are "new," and the ash pump is hard at work getting the "old" overboard.

10 a. m., back to Sag Harbor; direct, past Cedar Island. Another train to meet, but it is late, and then once more to New London and return.

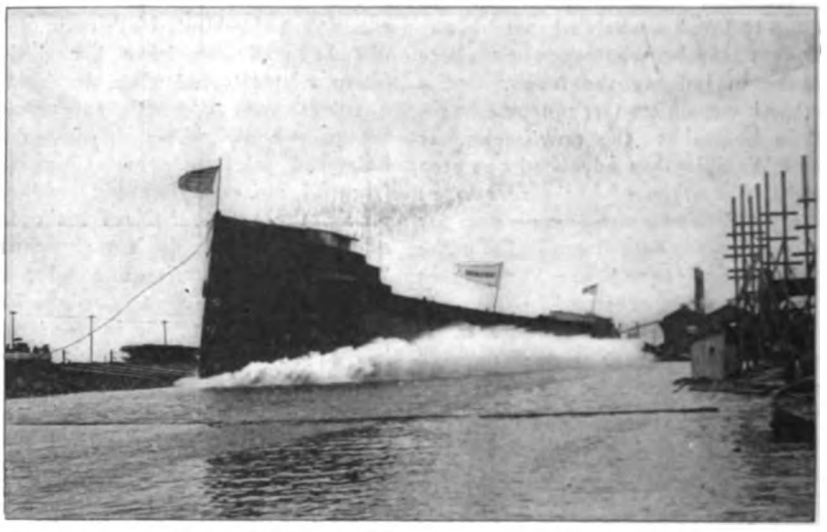
7:30 p. m., make Sag Harbor dock.

The day's work is done; the captain has gone home, the pilot is fishing over the after rail, the firemen are sharing a can of beer on the dock and the engineer—he is sitting on the stringpiece watching the longshoremen who wheel the coal on board for tomorrow's trip. That coal has to go into the forward bunker; as close to the stokehole as possible (for else the firemen shall have to trim). A good general guards the interests of his soldiers. In such a rural community as Sag Harbor, 9 p. m., is bed time. And it is also the chief's bed time, for he must be up and doing again at 4 a. m. "Two Bells—Good night."

LAUNCHING THE STEAMER ISHPEMING.

The bulk freighter Ishpeming was launched at the Ecorse yard of the Great Lakes Engineering Works on Saturday last for the Cleveland Cliffs Iron Co., and was named by Miss Agnes Hayden of Ishpeming. The steamer is a sister of the Michigan, recently launched at this same yard. She is 550 ft. over all, 530 ft. keel, 56 ft. beam and 31 ft. deep. She has 33 hatches, spaced 12 ft. centers. Her engines are triple-expansion with cylinders 23, 37 and 63 in. diameters by 42 in. stroke, supplied with steam from two Scotch boilers, 15 ft. by 12 ft., fitted with induced draft and allowed 175 lbs. pressure. The launching was successful in every way, and the Michigan was the first to salute her sister as she took the water.

The launching party was small, those present on the stand being Miss Agnes Hayden, Mrs. Barbour and Mrs. George Hayden, of Ishpeming; Mr. J. H. Sheadle, Mr. T. H. Hogsett, Mr. C. E. Adams, Alexander Hynd, F. A. Scott and H. N. Herriman, of Cleveland; Capt. and Mrs. S. A. Lyons, Capt. J. M. Johnston, Antonio C. Pessano and John R. Russel. At the conclusion of the launch luncheon was served in a special car and the launching party were later entertained at the Country Club. The Ishpeming will be commanded by Capt. C. E. Sayre.



LAUNCHING THE STEAMER ISPHEMING.
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AT THE HEAD OF THE LAKES.

Duluth, July 1, 1906.—The last week of the month at this port has been a big one and it has seen some records broken. Coal, ore, grain and lumber shipments have all been relatively large. The receipts and shipments of grain for the week ending June 30 are given as well as those of the week previous from which comparison the increase is plainly shown.

	Receipts		Shipments	
	June 23	June 30	June 23	June 30
Wheat	168,264	299,483	251,757	250,684
Corn	....	5,133	....	....
Oats	148,218	349,338	1,247,009	550,577
Barley	18,079	81,458	34,161	32,076
Rye	746	1,319	....	....
Flaxs'd	158,469	295,549	275,990	376,192

The largest coal cargo delivered on Lake Superior this season was brought to Superior Tuesday, June 26, by the Joseph G. Butler, carrying 10,688 tons. It was immediately followed by the H. B. Smith which brought a 10,366-ton shipment, making the day a record breaker in the matter of coal receipts. The coal cargo record to the head of the lakes was made by the A. B. Wolvin when it came up last year loaded with 11,140 tons. In unloading the Smith at the Northwestern Fuel Co.'s Winter street dock another record was also made in discharging a cargo of coal at this port. In 19 hours of actual working time, four hoists unloaded the 10,366-ton cargo, which is an average of 545.5 tons per hour.

The Robert Holland, Capt. J. T. Lennon, and owned by Shannon & Garey of Saginaw, Mich., a lumber boat which was sunk under peculiar circumstances in the harbor last Monday, has been pumped out and raised by the Union Towing & Wrecking Co. The accident is explained by the captain as resulting from the fact that the boat had no coal in her bunkers and was therefore made topheavy by her deck load. After being supplied with coal, the Holland will proceed reloaded for the lower lakes.

The aerial bridge over the Duluth ship canal, which was to cost according to contract $100,000 and on which the last payment was made to the Modern Structural Steel Co. of Waukesha, Wis., Monday, June 25, has cost actually, including interest, $110,407.15. This final settlement avoids a prospect of considerable litigation and closes this interesting undertaking.

The entry to Superior harbor is to be equipped with a new lighthouse, definite plans of which are not yet available. According to local information it is to be placed on the new south concrete pier and about 500 feet further out in the lake than the old one, which was destroyed in the storm of last November. It is expected that the lighthouse and whistle house will be built of brick and stone and be similar to the one on the south pier of the Duluth ship canal. The pier construction will also make an inner range light necessary, as is also the case at Duluth.

The steamer D. Z. Norton unloaded 8,545 tons of ore at Conneaut in six hours and 30 minutes last week. This is a good record but a better one could have been made had there been a sufficient supply of cars.

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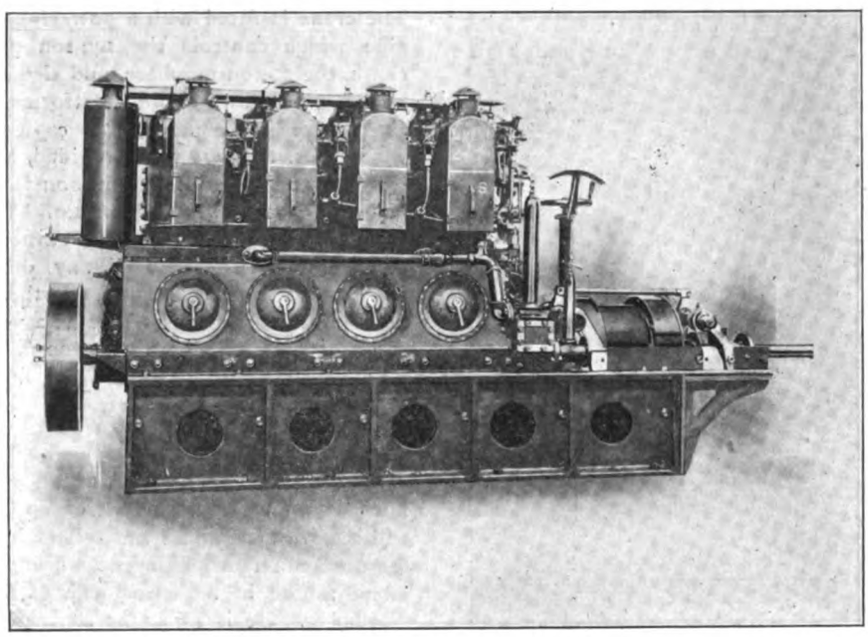
ENGINES OF A SMALL PARAFFINE MOTOR LAUNCH.

A small paraffine motor launch built for the London government has just been constructed by Messrs. R. Hornsby & Sons, Ltd., Grantham, in Britain. The launch which is intended for service at Khartoum, is 30 ft. long by 8 ft. beam, and has a mean draught of about 18 in. It is driven by one of the firm's marine type of oil engine. The motor, which is 20 brake horsepower, is compact and takes up only a small amount of floor space. This



ENGINES OF A PARAFFINE MOTOR LAUNCH.

engine is claimed to be a distinct advance on the usual Hornsby-Akroyd stationary type of engine, so far at least as speed of running and weight are concerned. The weight of the engine fitted in the launch, together with air and exhaust pipes, starting receiver and clutch is one ton, that is 112 lbs. per brake horsepower. The total weight of all the machinery and accessories carried is said to be one ton, one cwt. The engine has three cylinders, bolted on to a common bedplate. Each cylinder is 6½ in. diameter by 7¼ in. stroke. The normal speed of running is 600 revolutions per minute, but it is claimed that the speed can be reduced to 200 revolutions per minute when necessary. Ignition is effected by hot surface contact helped by the high compression of 90 lbs. per square inch. This is the same method as adopted in the ordinary stationary engine of this make. In fact, in principle this engine does not differ at all from the land type. The speed of the engine is regulated by alternating the supply of fuel passing into the vaporizers. Should the speed exceed the normal, the governor comes into action and causes the fuel to pass down an overflow pipe, and back into the storage tank. The oil is supplied to the vaporizer by means of pumps on to each cylinder. Each pump has three steel ball valves, both for suction and delivery, and the supply of oil is regulated by alternating the stroke of the pump which can be readily done. The speed of running is regulated by this means, as the timing of the ignition on the Hornsby-Akroyd engine is constant and cannot be varied when running. Lubrication is effected by the splash method, the crank running in an oil bath. However, for larger engines, forced lubrication is adopted. For starting purposes a receiver is used in which air is compressed to 90 lbs. per sq. in. pressure by means of a pump.

The receiver is charged by the motor when the latter is running. The power of the engine is transmitted to the propeller through a clutch of the expanding shoe type. No gear is in action when the boat is going ahead, the whole machinery revolving with the shaft. When going astern the clutch case is fixed to the engine framing, and the drive is then through bevel gearing, which rotates the propeller shaft in the reverse direction. The engines, it will be seen, take up little floor space, and the necessary tanks are conveniently situated, leaving a large amount of accommodation for so small a boat.

During a series of trials on the Humber at Hull, the launch behaved well and gave satisfactory results, a mean speed of 7.8 nautical miles per hour being obtained. The capabilities of the launch for starting, stopping and reversing were also tested and proved to be satisfactory.

AN EXCELLENT GARMENT FOR VESSEL MEN.

The clothing manufactured under the name of Raino by the E. A. Armstrong Mfg. Co., 315 Wabash avenue, Chicago, is guaranteed to be absolutely waterproof. It has been extensively used by hundreds of officers in the army, especially on the Pacific coast, where it rains almost continuously in the winter, and in the Philippines, Panama and other torrid zones, and has successfully withstood the severe tropical rains, which are very much heavier than those in other parts of the country. The cloth is not oily, has no rubber in its composition, is very clean and does not stick. It is very light for a hard service garment, the jacket weighing only about three pounds and a long coat only about 4 to 4½ pounds. It is well cut and nicely made and can be packed in trunk or locker with other clothing, as it does not injure other fabrics. The Armstrong company is receiving a great many calls for this clothing throughout the east for vessel purposes. Raino goods are certainly much superior to the waterproof garments worn heretofore. They cost more than oil goods but are much more satisfactory, much more durable and improve with age. A bag of Raino was made last winter, filled with water and put on a steam coil and kept there for about two and one-half months. Another bag was filled with lake water on Dec. 16 last and has been kept filled ever since. For the purpose of giving exceptionally hard service on these goods a coat was put into service last September in the Chicago fire patrol and another one in Engine Co. No. 1. The one in the fire patrol was taken back after about six months' service. It showed very hard wear, but is really softer, pleasanter to feel, and just as waterproof as when it was first used. The one left with the engine company is still in use and is seemingly as good as new after ten months' service. The captain and officers of the company praise the coat very highly. Such service as the engine company gave it is greater than it would receive in possibly three years' service on the lakes. The company will be pleased to send samples of these goods to anyone aboard ship who might be interested in it.

The new steel ferry boat Babylon, building at the yard of the Harlan & Hollingsworth Corporation, Wilmington, Del., for the Long Island Ferry Co., was launched last week. This ferry is 203 ft. long, 65 ft. beam and 17 ft. 6 in deep.

Seth E. McDonald, an old lake ship builder, died at Bay City last week at the age of eighty-five years.

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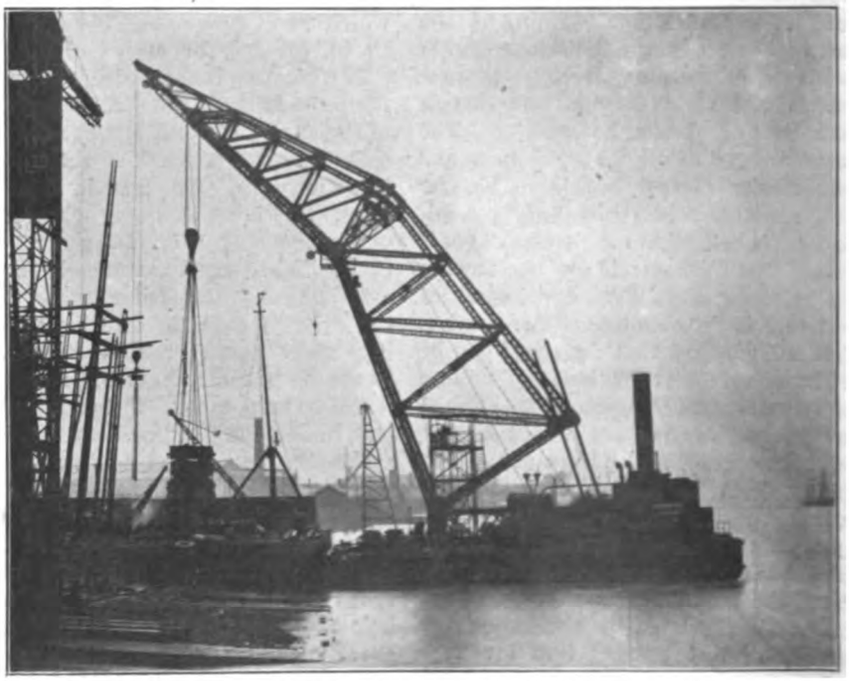
A HUGE FLOATING CRANE LIFTING 140 TONS.

Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, have just had built for them a powerful floating crane, capable of dealing with weights up to 140 tons. The Titan, as the crane has been called, will be used by its owners for placing the boilers, turbines, and other heavy weights in the 25-knot Cunard steamer Mauritania, after the great vessel is afloat, which, as everyone knows, they have on the stocks, and nearly ready for launching. The floating crane is self-propelling, so that by means of its own steam, it can be maneuvered from place to place as required. In the hull or pontoon are four sets of screw engines with propellers, all of which can be used to propel the pontoon with its lofty crane in a forward direction. Two of these engines are so arranged that, by means of clutch gear and two extra propellers, side or lateral movement can be obtained. To effect accurate and easy steering two rudders are fitted to the pontoon.

The crane structure is from the designs of, and has been supplied by the Duisburger-Maschinenbau-Actien Gesellschaft, of Duisburg, Germany, who have supplied a number of somewhat similar but less powerful appliances to continental ship building and engineering companies and port authorities. As already stated the Titan is capable of dealing with lifts up to 140 tons, and this is at a maximum outreach of 44 ft. beyond the side of the pontoon on which the crane is fitted. Arrangements have also been made for dealing with smaller lifts up to 20 tons at a proportionately greater outreach. In rapidly handling weights up to five tons, a traveler has been fitted on the top portion of the gib, so that light weights can be lifted and deposited without luffing the gib. The crane is fitted with a powerful engine which controls the 140-ton purchase, the 20-ton purchase, and also the luffing gear. Two sliding platforms to receive boilers or other lifts, capstans, windlasses, etc., are also provided, and provision is made in the pontoon for a large quantity of water ballast. The lifting capacity of the new crane is considerably in excess of any other crane or shearlegs on the northeast coast of Britain, and has become a very necessary equipment owing to so many war and mercantile vessels of large size being constructed there.

A GIANT FLOATING CRANE.

Capt. W. W. Smith, the marine superintendent of the Pittsburg Steamship Co., will remove the engines and boilers from the wrecked steamer Lafayette, which was swept ashore in the great gale of last November. He is using the steamer A. B. Wolvin for this purpose, which has been fitted with the necessary wrecking equipment by the American Ship Building Co.



ANOTHER VIEW OF THE CRANE.

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LAUNCHING THE BATTLESHIP NEW HAMPSHIRE.

The battleship New Hampshire was successfully launched at the yard of the New York Ship Building Co., Camden, N. J., on Saturday morning last, and was named by Miss Hazel E. McLane, daughter of Governor McLane of New Hampshire. Miss Marion Shortwell, of Cambridge, and Miss Margaret Thayer, of Concord, N. H., were maids of honor.

The propelling engines of the battleship New Hampshire will be right and left, placed in water tight compartments and separated by a middle line bulkhead. The engines will be of the vertical, inverted-cylinder, direct-acting, triple-expansion type, each with a high-pressure cylinder 32½ in., an intermediate-pressure cylinder 53 in., and two low-pressure cylinders 61 in. diameter, the stroke of all pistons being 48 in. The indicated horsepower of propelling engines will be 16,500 when making about 120 revolutions per minute, and with a steam pressure of 250 lbs. at the high-pressure cylinder. The order of cylinders, sequence of cranks, number of main valves, framing, etc., is to be similar in design to the engines of the North Carolina and Montana. There will be two condensers, each with a cooling surface of about 10,375 sq. ft., measured on the outside of the tubes, the water passing through the tubes. The circulating and air pumps are independent, of suitable size, and similar in design to those for the North Carolina. There will be twelve water-tube boilers, placed in six water-tight compartments, with three smoke pipes. The total grate surface is to be 1,100 sq. ft., and the heating surface at least 46,750 sq. ft. Provision is to be made for forced draft by blowers discharging into air-tight fire rooms, there being two blowers in each boiler compartment.

The general dimensions and features of the New Hampshire are as follows: Length on load water line, 450 ft.; breadth extreme at load water line, 76 ft. 10 in.; displacement on trial, 16,000 tons; mean draught bottom of keel, 24 ft. 6 in.; total bunker capacity, 2,350 tons. The main battery is to consist of four 12-in. breech-loading rifles; eight 8-in. breech-loading rifles; twelve 7-in. breech loading rifles and four submerged torpedo tubes. The second battery is to consist of twenty 3-in., 14-pounder, rapid firing guns; twelve 3-pounder semi-automatic guns; four 1-pounder semi-automatic guns; two 3-in. field pieces, two machine guns of .30 caliber and two automatic guns of .30 caliber. The 2-in. guns are to be mounted in pairs in two electrically controlled, balanced, elliptical turrets on the center line, one forward and one aft, each with an arc of fire of about 270 degrees. The 8-in. guns are to be mounted in pairs in four electrically controlled, balanced elliptical turrets, two on each beam at each end of the superstructure. The 7-in. guns are to be mounted in broadside, protected by 7-in. armor, the forward and after guns being arranged to fire right ahead and right astern, respectively. The hull is to be protected at the water line by a complete belt of armor, 9 ft. 3 in. wide, having a uniform thickness of 9 in. for about 280 ft. amidships, gradually decreasing to 4 in. at the stem and stern. A complete protected deck will extend from stem to stern.

WHITE STAR LINER ADRIATIC.

The Adriatic, which is building for the White Star line at the yard of Harland & Wolff, Belfast, Ireland, is considerably over 700 ft. long, 75 ft. beam and about 50 ft. deep. Her gross tonnage will be about 25,000 and her displacement will exceed 40,000 tons. A noteworthy element of the vessel, besides her size, is that of safety. In addition to the general strength of the structure, the double bottom extending the whole length of the ship is a special element of both strength and safety. The double bottom is 5 ft. 1 in. deep, except under the engines, where it is 5 ft. 10 in. to give greater rigidity in the neighborhood of the machinery, and besides securing the safety of the vessel if she should take the ground, it also provides an economical means of carrying ballast. The tanks or cells of the double bottom will hold several thousand tons of water, and the powerful pumps with which the ship will be equipped will enable these spaces to be filled or emptied of water in a very short time.

The Adriatic is an exceptionally strong structure. She has nine steel decks. Her frames are composed of steel channel bars and she has eleven water-tight bulkheads subdividing the vessel into twelve water-tight compartments. Many of the shell plates are over 30 ft. long and 5 ft. wide and weigh between 3 and 4 tons. A large amount of the riveting throughout the hull has been done by hydraulic machines, the full headed rivets thus driven affording visible evidence of strength as well as of the quality of workmanship.

The arrangements for cargo will be very complete, there being seven cargo holds, two 'tween deck holds insulated and two holds fitted as deep tanks. The great feature of the vessel will, however of course, be the passenger accommodation, and the Adriatic will be capable of carrying about 3,000 passengers, besides officers, engineers and crew amounting to over 400.

The accommodation will be in the usual luxurious style for first class, for whom a large number of separate and distinct suites of apartments are provided, consisting of stateroom, sitting room, bathroom, etc., and the huge dimensions of the vessel will be taken full advantage of in the size and location of the dining saloons, libraries, smoking rooms, etc., and in providing promenade space for first, second and third class passengers, and throughout the whole of the living spaces the three essentials to health and comfort, viz. roominess, ventilation and light will be in evidence.

Of course, on such a vessel as this, in addition to the propelling machinery, there is an enormous amount of auxiliary machinery—the steering engines, the electric light machinery, the refrigerating machinery, the deck machinery, such as the windlass and winches, are all items necessary to the efficient working of the vessel.

As may easily be imagined, the cables and anchors of the Adriatic are of gigantic size, the cables being 3⅛ in. in diameter and weighing about 90 tons, and the anchors weighing about 8 tons each. The total number of steel plates in the ship will be close on 20,000, and the rivets nearly 2,500,000.

NEW YORK NAVY YARD ADOPTS STEAM TURBINES.

The navy department in its recent power extensions to the New York navy yard has, through its bureau of yards and docks, adopted Westinghouse-Parsons steam turbines, which will be installed in building 41. The present installation will comprise two 500 K. W. units, operating under 150 lbs. steam pressure, 28 in. vacuum and on superheated steam at 100 degrees Fahr. The power plant supplies three-phase alternating current at 2,300 volts, and 60 cycle frequency, to machine shops, dry docks, and other general purposes about the New York yards, including lighting of buildings. The contract for these turbines was secured on rigid government specifications and under strong competition. Boilers will be of the Stirling water tube type, with Foster internal superheaters. Worthington surface condensers will be used. This will make the second turbine plant that the Westinghouse Machine Co. has installed for the navy department, the first one being at the Boston navy yard, where the turbines have been giving very good service.

Because of the senate's failure to confirm the Isthmian Canal Commission, President Roosevelt has appointed a new commission, consisting of Theodore P. Shonts, chairman; John F. Stevens, Gov. Charles E. Magoon, Brig. Gen. Peter C. Haines, Mordecai Endicott and Benjamin M. Harrod. Mr. Stevens replaces Gen. Ernst who retires for age, but will continue to serve as chief engineer.

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EQUALIZATION OF POWER IN MARINE ENGINES.

The above formed the subject of an interesting discourse by Mr. Thomas Southern at one of the periodical meetings of the Sunderland branch of the Association of Marine Engineers in Britain, and it has been thought of sufficient importance and interest to the members, who are to be found in all parts of the world where shipping is carried on, that it has been reproduced in the June official report of that organization. Besides having branches in all the British ports, the association has also agencies at New Orleans, Pensacola, Philadelphia and Savannah, U. S. A., and these may be interested to know that, as far as the British branches are concerned, there is being inaugurated a more vigorous policy with the view of securing legislation in the interests of the profession, and also imparting knowledge of peculiar interest to the members, such as the address under notice. Readers of the MARINE REVIEW will doubtless find something to interest them in this address, which we give in Mr. Southern's own words.

Mr. Southern said: "When I accepted the invitation of your secretary to address you my chief difficulty lay in finding a subject which would be suitable and one which to my mind would be useful and helpful to you in your work. After thinking the matter carefully over, I came to the conclusion that the best thing would be to speak to you on the equalization or distribution of power, because I think it is especially useful to marine engineers, and with that object in view I intend to deal for a little with the ordinary type of marine engine in general use, viz., the tri-compound, although the same argument applies with equal force to the two-cylinder or four-cylinder compound engines.

"My remarks are particularly applied to marine engineers, as it is necessary that an engineer to be fully qualified to perform his duties efficiently should know how to alter the cut-off of steam by the lap on the valve, or by the use of the adjustable lever to which the drag-links are attached, if there are not any adjustable levers, liners may be used between the foot of the drag-links and adjustable brasses; for by their use an intelligent engineer can rearrange the distribution of power and practically make all the engines develop an equal amount of I. H. P.

"I have no doubt that many of you gentlemen present will have noticed that when trial trips have been run, that the power of the engine varies a great deal.

"There are such varying conditions existing in engines under which steam imparts with its energy, that it is difficult for the engines to be designed which will develop an equal amount of power in each. When the variation of power is great it will be found that the top-ends, crank-pin brasses, or main bearing brasses of the engines developing the most power are not running smooth and cool; the remedy does not lie with the particular parts of the engine, as any amount of overhauling will not make them run smooth and cool; the remedy lies at the slide valve, and it is wonderful the number of alterations that can be made by the lap of the valve or the links.

"The first thing an engineer does when he gets to sea and fairly under way is to take a series of indicator diagrams from each of the three engines, seeing that the boiler pressure and vacuum remain the same as near as possible. He will now proceed to find the mean pressure on each diagram, and find the average pressure of the number taken for each respective cylinder, and work out the I. H. P. for the H. P. and M. P., and L. P. engines, and I am sure he will find out some great discrepancies, having got the average power of the three engines.

"The use of the links may now be made to play third part, with which he is enabled to link up or open out, and alter the position of the valves so that the steam will be cut off sooner or later, as desired. It is not desirable that an engineer should link up to any considerable extent, for the reason that it alters the leads, shortens the travel of the valve, and is slower in opening and cutting off to steam, the alternate being the slide valve.

"I should like to emphasize this point in equalizing, it is not necessary to alter the H. P. valve or links so long as the same total power is required. For instance, if I link up the H. P. slide valve the effect will be to cut off the steam sooner, and as less steam is used the average press on the steam side of the H. P. piston is reduced. It will now be found that the pressure in the M. P. steam chest is also reduced; therefore, a reduction of back pressure on the exhaust side of the H. P. piston, and practically the mean effective pressure and I. H. P. on the H. P. piston remains unaltered, as there is a reduced initial pressure in the M. P. and L. P. cylinders with the same cut-off, it naturally follows that their respective mean effective pressures and I. H. P. must be reduced. By linking up the three engines with the reversing gear, the steam will be cut off earlier and less steam will pass each cylinder, the total I. H. P. will be diminished, also, there will be practically the same drop of power in each of the three cylinders, the ratio of expansion in each engine being altered in the same proportion.

"The method of altering the power of the different engines with the links will be simplified if the engineer remembers that by linking up the M. P. valve gear the steam is cut off earlier in the M. P. cylinder. As a less volume of steam is used, the pressure rises in the M. P. steam chest; there will, therefore, be an increase of back pressure in the H. P. piston, and consequently a reduction of power on it; this loss of power in the H. P. will be transferred to M. P. cylinder. The increase of initial pressure in M. P. more than counterbalances the loss of power sustained by the early cut off the L. P. engine in this case will remain unaltered. The reverse order will occur if the links are opened out.

"By linking up the L. P. valve gear the steam is cut off earlier in its cylinder. As a less volume of steam is used, the pressure rises in the L. P. steam chest; there will, therefore, be an increase of back pressure on the M. P. pistons, and consequently a loss of power on it. This loss of power in the M. P. will be transferred to the L. P. cylinder. The increase of initial pressure in the L. P. more than counterbalances the loss of power sustained by the early cut off. The H. P. engine will remain unaltered. The reverse order will occur if the links are opened out. It is easily seen, then, that the powers may be varied tentatively by the links; and having got the desired powers, the engineer may alter the lap on the side valve, so that he may get the final cut off, and run the engines with the links in full gear.

"I will now endeavor to show you how this may done practically. Suppose the steam is carried 20 in. of the stroke, with the links in full gear, and by linking up the steam is cut off 2 in. earlier in the stroke, the amount of lap to be put on the valve can be found by putting the links again in full gear; turn the engines down (if working from the top) till the slide valve just covers the steam port, and the piston will be 20 in. from the beginning of the stroke. Now, mark the shoe and guide, then turn the engine back till the marks in the shoe and guide are two inches apart. It will now be found that the steam port is opened again. The port opening is the amount to lap the valve at each end and advance the sheave till the desired lead is obtained. The part of the sheave covering the key-way in the shaft will have to be cut off, and a step put on the opposite side of the key. In carrying the steam further, the opposite to the above would have to be done."

A number of examples were given on the blackboard, also sketches of indicator diagrams, and effects produced due to the alteration of the links.

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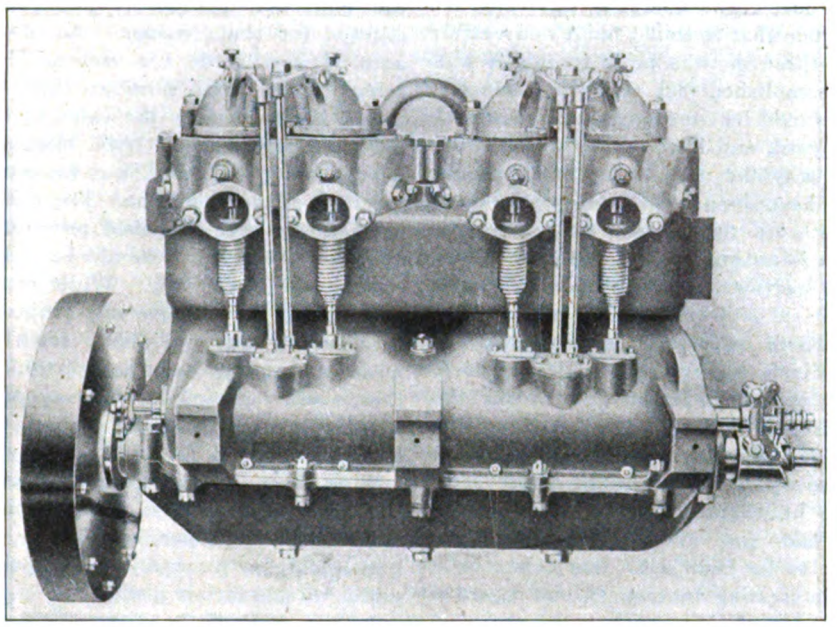
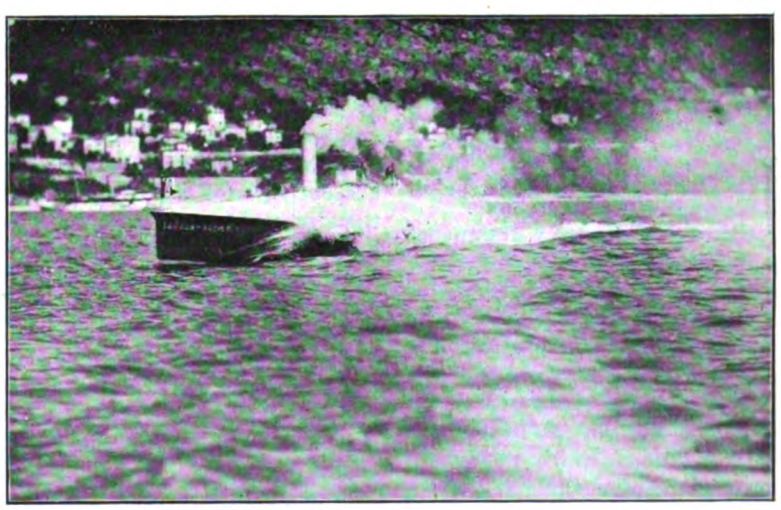
YARROW NAPIER TORPEDO BOAT.

Messrs. Yarrow & Co. have turned out from their works an interesting craft, driven by petrol motors and which might be termed a second class torpedo boat, 60 ft. in length by 9 ft. beam. This motor boat has excellent sea-going qualities—as good as could be expected from a craft of such dimensions. It is strongly built and cannot be looked upon in any sense as coming under the category of a purely racing boat. In the opinion of some it is destined to play an important part in the destinies of the world's navies in the near future. Such a launch would be admirably adapted to serve as a second-class torpedo boat, if fitted with a "revolving torpedo tube," so as to discharge the torpedos over either side, or it might be fitted as a gunboat for coast-guard service to chase smugglers. Owing to its light weight, which, including the hull and propelling machinery, would not exceed eight tons, it is quite easy to send such a craft on board an export vessel to almost any part of the world. If such a launch be fitted with torpedos, it certainly does appear to be eminently adapted for the defense of a port or a coast, and it may be a question whether a certain amount of money would not be more advantageously expended in obtaining a large number of such craft, rather than few vessels of larger size. For example, the cost of one modern destroyer is equal to about 15 such torpedo launches, and for the purpose of defending a port from an attacking or blockading fleet, there cannot be a second opinion that 15 small vessels of high speed, which it would be difficult to hit, offer a much greater means of defense, than one destroyer of larger size, unprotected, upon which the fire of a number of guns could be concentrated. The above conclusions are more or less the result of a series of trials recently made on the Thames, when she averaged 25½ knots, a result, according to Mr. Yarrow, hitherto unattained by a boat of this character and dimensions. The best speed that could be obtained under the same conditions with steam would be 20 knots. This increased speed is no doubt due to more than one cause. Firstly, the much lighter weight of the machinery of the internal combustion type as compared with steam; probably the saving in weight is 50 per cent. Secondly, the form of hull, which at these extreme speeds, for the displacement of a boat of this type, seems to enable it to rise on the surface of the water, and, as it were, to some extent slide on the surface. This is made evident by the small surface disturbance of the water, which is very remarkable; thus, the portion of the power which is usually expended in producing surface disturbance, or what is called wave-making, is utilized for propulsion.



THE 75 H. P. NAPIER LIGHT MARINE MOTOR.

The machinery in the launch consists of three sets of Yarrow-Napier internal combustion engines, driving three screws, each of the two outer propellers being driven by engines of about 120 H. P., and the center propeller by an engine of 60 H. P. The two outer propellers are only capable of going ahead, while the central engine can be reversed, it being considered that this amount of reversing power is amply sufficient. The engines are constructed under license from Messrs. Napier & Edge, Ltd. The Yarrow-Napier torpedo boat is believed by experts to be a craft destined to make history. In a trial run over a distance of 176 knots she did a mean speed of 24.5 knots, or 28.12 miles per hour right through. The engines ran like a clock from start to finish and were never stopped the whole time. The petrol consumption during the whole run was 220 gallons, and as the boat can carry 350 gallons, this would enable her to cover a distance of 321 miles at full speed.



YARROW-NAPIER TORPEDO BOAT.

WILL BUILD DREDGES.

The Maryland Steel Co. has secured the contract for the construction of two sea-going suction dredges for the Isthmian Canal Commission. The lowest bidder was Wm. Simon & Co., Renfrew, Scotland, their tender being $327,000 each, or $654,000 for the two, against the Maryland Steel Co.'s bid of $362,000 each or $724,000 for two. It was felt that the cost of inspection abroad and the cost of delivery to the Isthmus would be such as to seriously minimize the apparent financial advantage of the British bid. Moreover, the Maryland Steel Co. has achieved a great reputation in dredge designing and building.

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LOUISIANA-CONNECTICUT CONTEST.

The recent commissioning of the 16,000-ton battleship Louisiana at the Norfolk navy yard, where she was delivered by the Newport News Ship Building & Dry Dock Co., in accordance with the terms of the contract, brings to a close a notable contest that has been pending for the last forty-two months. It was an experiment authorized by congress to demonstrate whether the government could, in its own navy yard, build a vessel as cheaply and as quickly as a private ship yard, and the victory, if it may be so termed, both as to cost and time, belongs to the private concern.

This so-called contest was between the battleships Connecticut and Louisiana. They are sister ships, constructed on the same general plans and are as nearly identical as it was possible to build them. The Connecticut, which is being built at the Brooklyn navy yard, is not yet in commission and just when she will be completed depends on when the additional appropriation asked for is available. These vessels were authorized by an act of congress approved July 1, 1902, which provided for the construction of two battleships to carry the heaviest armor of their class upon a trial displacement of 16,000 tons, and to cost not exceeding $4,212,000 each. The act directed that one of the ships be built in such navy yard as the secretary of the navy designated, and in order that the difference in cost might be definitely known the following provision was made:

> The secretary of the navy is hereby instructed to keep an accurate account of the cost of inspection and construction of vessels provided for in this act, whether built in government yards or by contract, and report thereon to congress, at each session, the progress of the work and cost thereof, including the inspection of all material going into the construction of said vessels, and, upon the completion thereof, to report a full and detailed statement showing the relative cost of inspection and construction in government yards and by contract.

The secretary of the navy designated the Brooklyn navy yard as the place where the Connecticut should be constructed. This is unquestionably the best equipped yard maintained by the government. It is advantageously situated, being in close proximity to the manufacturers of the auxiliary machinery and fittings which enter into the construction of a ship and which the builder purchases. Besides, the yard has the advantage of unsurpassed railroad facilities. To the average reader this may appear trivial, but not so with the ship builder, who must depend on the rolling mills to furnish him material and the railroads to lay it down in his yard with the quickest dispatch.

The contract for the Louisiana was awarded to the Newport News Ship Building & Dry Dock Co. by the secretary of the navy, after advertising for competitive bids, that company's tender of $3,090,000 being the lowest. On Oct. 25, 1902, the contract was formally executed and the work of building the ship commenced. Not until the bids were opened and it was found to be the lowest bidder, did the Newport News company have any assurance that it would build this vessel; but three months prior to this it was an established fact that the Connecticut would be constructed at the Brooklyn yard, and hence there was no reason why the preliminary work should not have been well under way when bids were opened for the Louisiana. This is an important factor, for before any work can be done toward laying down a ship the detail or working drawings must be made, submitted to the navy department and approved, and then material ordered from the mills and delivered by them.

From the start the Newport News company took the lead in the race. The Louisiana's keel was the first to be laid and the Louisiana was the first to be launched. But it has been an interesting contest. It was regarded as a test of the merits of the two systems, and for that reason the construction of the vessels has been closely followed by those interested in ship building. The lead was maintained by the private ship yard for some months, but on two occasions the Connecticut forged slightly ahead. This, however, the Newport News company overcame and held to the finish.

The progress of construction on a United States naval vessel is ascertained by taking a percentage of the gross amounts earned under the government payment schedule up to the end of each month. After the contract has been signed a division of the contract price is made for work coming under the cognizance of the bureau of construction and repair and the bureau of steam engineering, respectively. For instance, in the case of the Louisiana, it was decided after conference between the bureau of construction and repair and the bureau of steam engineering that the division of the contract price should be

For the hull	$2,090,000.00
For the machinery	1,000,000.00
Making the total	$3,090,000.00

The contractors were then furnished with a schedule giving the approximate weights and amounts to be allowed per pound for the various divisions of work under the bureaus of construction and repair, equipment and ordnance, all of which go to make up work on the hull of the vessel.

After the construction of the ship was begun the earnings on "hull" were estimated by the superintending constructor, stationed at the ship building plant, on the basis of the finished weights, from the date of the signing of the contract up to the end of each month, for material worked through the shops for the various divisions of the hull, and the prices per pound allowed for the divisions. An allowance is also made for materials received. The total earnings thus obtained are divided by the value of one per cent of the total "hull" allotment which, it will be noted, was $20,900 in the case of the Louisiana. The resulting figure is the published percentage of progress which, it should be noted, covers hull work only. While steam engineering percentages are estimated in a similar way, no public report is made of the progress of machinery, and this is not included in the reckoning, it being assumed that the engines will be finished when the hull is ready to receive them. It may happen at times that the percentage of completion of machinery is 50 per cent when the hull is only 40 per cent, but no public notice of this fact is given.

In the case of the Connecticut, instructions were given by the government that the returns from job orders issued for the various divisions of work on this vessel should be grouped according to the items in the payment schedule furnished the contractors for the Louisiana. It was also ordered that a proportionate amount of the salaries of navy yard officers, the clerical force of the yard and freight charges should be charged against the Connecticut in order to make the cost returns comparable with the earnings under the payment schedule on the Louisiana. Percentages of hull progress were then obtained in a similar manner to the method used on the Louisiana.

Under the terms of the contract for the Louisiana the contractor was required to maintain an average speed of 18 knots an hour in a four-hour speed trial in the open sea. A trial or speed test was held in accordance with this provision last December. The Louisiana was taken by the builders to the trial course laid off in the Rockland (Me.) harbor, where her screws were standardized, after which she made a four-hour forced-draft run in the open sea. On this run the Louisiana averaged 18.82 knots an hour and set a pace for her rival. During this trial the ship was manned by a crew picked from the workmen employed in the

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yard, the navigators being ship masters engaged in coastwise shipping. The fact that the Louisiana was sufficiently advanced to make the trip under her own steam from Newport News (Va.) to Rockland (Me.) in rough weather and undergo the severest test she will probably ever be subjected to, shows the state of her completion at that time.

As yet the Connecticut has not had her speed trial and she probably will not until after she is placed in commission. This is one advantage in favor of the government-built ship, as practically a month is lost in preparing for and running a speed trial. If the Louisiana had failed to make her contract speed thousands of dollars would have been deducted from the contract price for each fraction of a knot under the stipulated speed. Suppose the Connecticut should fail to make her speed, there could be no such deduction.

Now, as to relative cost. The contract price for the Louisiana was $3,900,000.00, while the amount allowed by the act of congress, exclusive of armor and armament, was $4,212,000.00. In addition to the contract price the navy department has authorized changes for which the contractor has been paid extra, about $130,000, making the total cost of the Louisiana $4,120,000. Up to this time the entire allowance of $4,212,000 has been expended on the Connecticut and owing to the fact that the appropriation is exhausted work has been suspended on the ship pending the action of congress. An additional appropriation of $380,000 has been asked as being requisite to complete the Connecticut and until this amount is forthcoming from the public treasury the vessel will remain in an uncompleted state. In round figures it has been demonstrated that the Connecticut will cost the government $500,000 more than the Louisiana, built in a short time by a private concern.

That the Brooklyn navy yard made splendid progress on the Connecticut must be admitted and the showing reflects great credit on the construction corps, but that it costs the government more to build ships in the navy yard has been clearly demonstrated. The house committee on naval affairs in its report submitted to the house of representatives, concedes this.

Concerning the Connecticut the report says:

> The committee recommends that the limit of cost of the battleship Connecticut, authorized by Act of Congress approved July 1, 1902, be increased to $4,600,000. This is an increase of $380,000 over the limit of cost provided for in the original act, and is made necessary by the increased cost of construction in navy yards

Concerning the two colliers now being constructed in navy yards the report further says:

> This committee further recommends that the limit of cost of each of the colliers authorized by Act of April 27, 1904, be increased to $1,550,000. This is an increase of $300,000 each. In said act it was provided that the colliers shall be built in the navy yards, one on the Pacific and the other on the Atlantic, and the additional cost is due largely, if not entirely, to the increased cost of government construction.

There are two training vessels under construction in navy yards, the original appropriations for which were $370,000 each, and the committee recommends an increase of $40,000 for each, significantly adding, "these ships are also being built in navy yards."

Counting the difference in cost between the Louisiana and Connecticut and the additional appropriations recommended by the house naval committee for the Connecticut, the two colliers and two training ships, all of which are building in navy yards, the increased cost to the government on the five ships has been about $1,180,000, and this does not include the difference between the asking price of a private ship builder for the construction of the collier and training ships and the total sum appropriated in the original acts. It is safe to say that any of these ships could have been built by a private ship builder for the sums originally appropriated.

There is no particular advantage to the government in building vessels at its navy yard, while, on the other hand, it is more expensive. There is sufficient repair work, such as the overhauling of our warships, to keep the navy yards busy the year round. No claim is made that a government-built ship is superior to the product of the private yard. The only difference between the two is that one is built by its own inspectors while the other is built subject to inspection. At every private ship yard where naval vessels are in course of construction are stationed naval constructors and inspectors who carefully look after the work and see that the plans and specifications are faithfully carried out Naval constructors are trained ship builders—men versed in every branch of naval architecture. They have been trained in the art in the best schools of the world.

President James C. Wallace, and other officials of the American Ship Building Co., called upon the board of public service of Cleveland last week to present plans for a new dry dock at the foot of Wedell street. The building of the dry dock would necessitate the using of a portion of the street. Nothing was done as the plans of the company are not yet well defined.

DIFFICULT TO GET SEAMEN.

In Atlantic ports in general, and in the port of New York in particular, the scarcity of seamen is decidedly much greater this summer than in any season during the last ten years. Yachts attracted an unusually large quota of the available supply of sailormen.

The wages on these pleasure craft are better; the food, in the majority of instances, is of the best and prepared by the most efficient cooks in the market. Then, also, clothing is furnished the sailors at the owner's expense.

Coasting schooners have only been occasionally delayed thus far on account of their inability to secure crews.

The sailors' wages (port wages) on these American vessels are $25 per month on schooners under 300 tons; $30 on ships over 300 and under 800 tons, while $35 per month is asked by sailors who consent to fill a berth on one of the few schooners of over 800 tons that clear from the port of New York. American coasting steamers offer $25 per month to sailors, and some of these steamers' officers have hard scratching to get the continuous vacancies filled. British tramp steamers and they are like Swedish matches, to be found in all nooks and corners, pay 4 pounds per month to those sailors who can be inveigled to sail for this amount out of an American port.

But it is difficult at this time of year to get a full crew for these boats.

And sailing ships—deepwater vessels—there is now generally a fleet of them at anchor in the Bay, provisioned, loaded, and with the "Blue Peter" flying from the fore truck—waiting for a crew.

And such crews as some of them get!

For instance, the bark Argentina, anchored in the lower bay, ready to proceed to sea after at last having succeeded in scraping together something in the shape of sailors, had to invoke the aid of the water police.

It appears that an officer assigned one of the crew to do some necessary work aloft—reeve halliards—but this "sailor" shuddered at the thought of going to a greater altitude than the shear poles—and then the fight commenced. The second mate in the hospital—dying—and the rest in jail.

But what caused the greatest drain on the—at the latter part of the winter—so abundant stock of seamen was the offers of contractors of structural iron work.

Men who formerly had not a mind above reefing, steering and splicing are now "iron bridge workers."

Sailors seem to be peculiarly well adapted for this kind of work, and they earn $4 per day, have "farmers' nights" and bank clerks' hours. Who would not be an "iron worker?"

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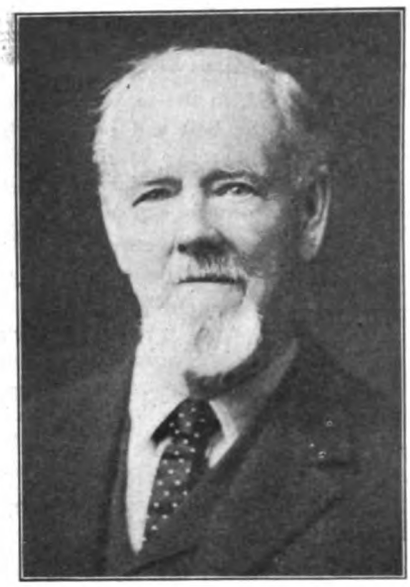
SCOVILLE CHECK VALVE.

The subject of this sketch, Charles L. Scoville, was born at Ashtabula, about seventy-three years ago. He entered the marine service on the great lakes in



MR. CHARLES L. SCOVILLE.

1852 as oiler on the Hendrick Hudson. The next season he entered as engineer on the propeller Genesee, where he remained until she was destroyed by fire in the fall of 1853. The next season he came out as chief engineer on the propeller L. L. Brayton, In the spring of 1858 he came out as second engineer of the propeller Chicago.

After making one trip he went to Cleveland and fitted out the Forrest Queen, which he engineered as chief until Nov. 24, 1860, when she went ashore at Bailey's Harbor, Lake Michigan. She was scuttled and sunk until the spring of 1861, when she was raised and he assumed his old berth. Mr. Scoville, in the spring of 1863, came out as chief engineer of the propeller Araxes, and in 1865 and 1866 as chief of the Rocket. In 1867 he pur-

chased an interest in the iron tug Dexter, with Capt. George Fields, and engineered her until the fall of 1868. He next shipped in the steamer Governor Cushman, leaving her after two trips, on account of a defective boiler. The next spring she exploded, killing thirteen men.

In the spring of 1869 Mr. Scoville shipped on the steamer Yosemite, and remained on her for five years. In 1874 he was made chief engineer of the Rocket, then owned by Mark Hanna. In 1881 he engineered the steamer R. J. Hacket as chief engineer. The next year he sailed as chief of the J. H. Osborne, and was with that steamer until she was run down and sunk on Lake Superior by the Canadian Pacific steamer Alberta. The the crew was taken off by the steamer Heckla.

In the spring of 1886 he helped build and put in the engines of the steamer J. H. Outhwaite, in which he went as chief for two seasons.

In 1888 he brought out the new steamer Bulgaria, engineering her until the swing bridge was completed at Ashtabula harbor, when he quit the steamer and took charge of that structure, which he continues to operate to this day.

He is a member of the Marine Engineers' Beneficial Association, and has forty issues of Marine Engineer's license. This wide experience as practical engineer demonstrated to Mr. Scoville, the same as to other engineers, that one of the most troublesome attachments in connection with boilers and engines was the check valve, it being impossible to get one that would work satisfactorily. As engineer of the swing bridge he had time and opportunity to experiment, and in 1904 he invented and patented what is known as the Scoville check valve.

This valve is so constructed that the disk, when seating, revolves, grinding itself when seating, insuring a perfectly tight seat, with no trouble from cocking, or sticking in any manner.

The valves have been in use in some of the largest steamers on the great lakes, and on railroad and stationary engines, and have been given very severe and thorough tests. The engineers cannot speak too highly of the improvement, and the universal opinion is that it will do all that it is claimed it will do.

The valves are now being manufactured and marketed by the Scoville Check Valve Co., at Ashtabula, Ohio, and orders are being filled promptly in all sizes.

GREAT LAKES ITEMS.

The steamer Joshua Rhodes, building at Lorain, will be launched about July 28.

Capt. Martin Swain is seriously ill at Harper hospital at Detroit. He was recently operated upon.

The International Waterways Commission, which was in session at Buffalo last week, has adjourned to meet again July 24 at Toronto.

The steel freighter Ungava was launched at the yard of the Collingwood Ship Building Co., Collingwood, Ont., June 27 for the Montreal Transportation Co. This steamer is 206 ft. over all, 41 ft. beam and 19 ft. deep and is intended for lake and river navigation.

The barge Manda which was on the rocks on Dallas Reef, Detroit river, had about forty damaged plates, of which twenty will have to be replaced with new ones.

Capt. A. J. McKay, of Detroit, master of the passenger steamer City of Detroit, has been appointed grand treasurer of the Ship Masters' Association in place of the late Capt. Thomas Jones.

The United States lake survey office has just issued new editions of the charts of St. Lawrence river No. 3 and Ashtabula harbor, both in colors. They are for sale by the MARINE REVIEW.

The steamer J. Pierpont Morgan, of the Pittsburg Steamship Co.'s fleet, took on a cargo of 11,270 gross tons, or 12,622 net tons, at Two Harbors last week for delivery at Conneaut.

The Canadian Masters and Mates' union has elected the following officers for 1906: Grand master, Capt. John Griffin, Toronto; grand first officer, Capt. Frank Scott, Collingwood; grand secretary and treasurer, Capt. H. O. Jackson, Toronto.

While running through a dense fog the tug Alfred W. struck a rock at Pie island, Lake Superior. The boat immediately sank in deep water, but the crew succeeded in reaching shore. The tug belongs to the Duluth & Lake Superior Dredging Co.

The steamer New Orleans was in collision with the steamer William R. Linn during a heavy fog on Lake Huron last week. The Linn tore a great hole in the side of the New Orleans, and she foundered within ten minutes, the crew escaping to the Linn. The collision occurred between Thunder island and Middle island in the early evening, the New Orleans being unbound with 2,600 tons of hard coal and the Linn down-bound with ore. The New Orleans was a wooden steamer built at Marine City in 1885. She was owned by John D. Hall, of Buffalo. The Linn belongs to the fleet of the Pittsburg Steamship Co.

Mr. George Y. Wisner, a noted civil engineer and member of the International Waterways Commission, died at Detroit this week at the age of sixty-five years. Mr. Wisner had achieved an international reputation as an engineer on waterways. Early in his engineering career he was connected with the United States Lake Survey and later entered the service of the lighthouse board. He had been connected directly and indirectly with numerous projects for the improvement of the inland waterways of the United States and his death is a distinct loss to the engineering profession.

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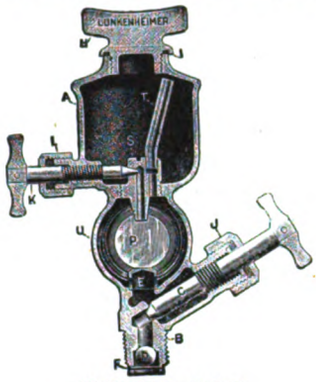
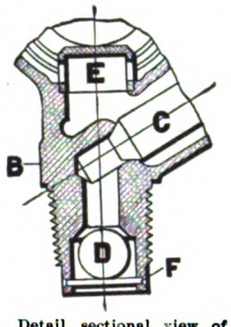
PREMIER LUBRICATOR.

Those interested in the lubrication of gas or gasoline engine cylinders would do well to write the Lunkenheimer Co., of Cincinnati, O., for their pamphlet describing their Premier lubricator which has been but recently placed on the market. The cup is made of the highest grade of bronze composition, the construction is very compact and the general design will undoubtedly appeal to users of this class of goods. The cup was constructed not only with a view to proper and positive lubrication, but also to readily withstand severe service. It is practically made and nicely finished, presenting quite a neat appearance, and there is positively no liability if its shaking to pieces owing to the jarring of the engine.

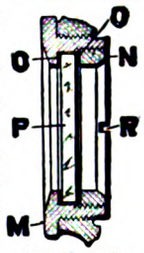


SECTIONAL VIEW.



Detail sectional view of shank, showing ball check D and baffling cap E.

The filling hole is very large, which users will undoubtedly appreciate, especially when the cups are applied to motor-boats' engines, as it permits the use of a filling can having a large spout. To positively insure a tight joint between the filling plug H, and top of cup, the plug is provided with a lead washer, I, which material, being softer than the brass upon which it bears, will readily conform to any irregularity that might exist between these bearing surfaces. It is almost impossible for this gasket to wear out, owing to the slight friction it is subjected to, but should the same wear, it can quickly and easily be renewed.



Detail sectional view showing improved construction of "bull's eye" sight-feed.

To permit of refilling the cup while the engine is running the valve C has been provided, which can be quickly closed and opened. The stem of this valve is well packed by means of stuffing box J.

The regulation of the feed is accomplished by means of the valve K. This valve is provided with a fine needle point, and the thread on the stem is also of fine pitch, hence a very close adjustment can thereby be obtained. The stuffing box L not only serves the purpose of preventing leakage around the stem valve K, but by means of it the proper amount of friction can be brought to bear on the stem and thereby prevent the unsetting of the valve. The object of the tube T, within the cup A, is to equalize the pressure on the oil, which permits the oil to drop by gravity through the sight-feed and thence to the cylinder.

To provide against the back pressure (which will more or less escape past the pistons) interfering with the proper formation of the drops in the sight-feed and causing the oil to spatter around the glass, the shank B of the cup is fitted with a large ball check valve D.

It has been found, however, that where the back pressure is unusually great, as in engines with worn piston rings, the ball check does not entirely remedy this trouble. To meet this condition a baffling cap, E, has been provided about the valve C.

The gases escaping past the ball check, D, are effectually muffled and diffused by means of the cap E, and hence the drops form perfectly, drop freely and steadily, and the sight-feed glasses never fill up.

Another important feature is the practical construction of the "Bull's Eye" sight-feed. This consists of the holder M, retaining ring N, two rubber washers, OO, and the "Bull's Eye" sight-feed glass P. The sight-feeds are made of a superior grade of glass and are very thick, so that unless broken by some external cause, it is very seldom if ever that they break.

Should accident happen to them, however, the improved arrangement of holding the glass permits of their easy renewal. It is only necessary to remove the holder M, after which the retaining ring N can be removed by placing a nail in one of the slots R, and giving it a slight tap with a hammer, when it can easily be removed with the fingers.

The Premier lubricator is manufactured only by the Lunkenheimer Co., of Cincinnati Ohio, and is but one of a large variety of specialties which are so highly appreciated by manufacturers of gas and gasoline engines.

At a general meeting of the public affairs committee of the Comercial Club of Duluth the shipping bill now before congress was unanimously endorsed. The Minnesota senators and representatives in congress were so notified.

A THERMIT REPAIR.

The alumino-thermic process of producing liquid steel, superheated to an extraordinarily high degree, and its practical application to the welding of iron and steel bars, rails, fractures, etc., of almost any section, reviving dull iron in foundries and many special purposes, is by

FIG. 1.

no means unfamiliar to Americans who have followed the technical press for the last three years.

Thermit is the name applied by Dr. Hans Goldschmidt, of Essen, Germany, to his mixture of iron oxide and powdered metallic aluminum, the combustion of which when ignited has proven to be one of the most spectacular, remarkable and valuable developments in metallurgy. Briefly, a thermit weld consists in enclosing the parts in a thoroughly dried sand-and-flour mold and pouring through and around the parts the highly super-heated thermit steel, produced in a magnesia lined crucible conveniently placed. A complete fusion and a thorough amalgamation takes place and when the parts have cooled and solidified, all trace of a joint is obliterated and continuous metal obtained.

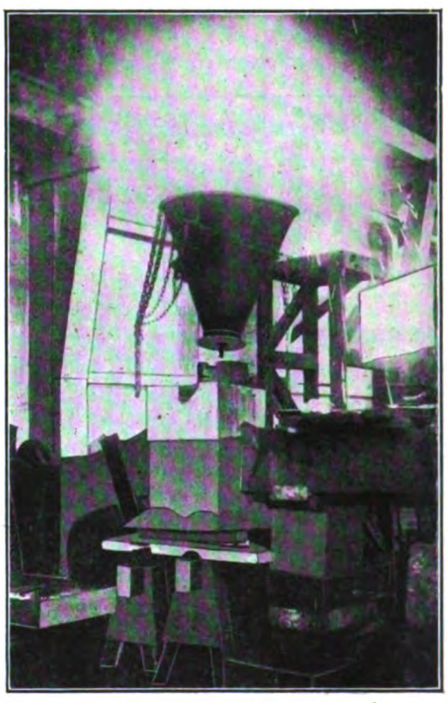


FIG. 2.

A most interesting example of thermit repairing was that recently accom-

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plished by Mr. L. Heynemann, consulting engineer, at San Francisco, Cal., upon a large forged steel dredge bucket arm measuring 2 in. thick by 12½ in. wide at the break. The fracture was complete, as shown in Fig. 1.

To facilitate the flow of thermit steel

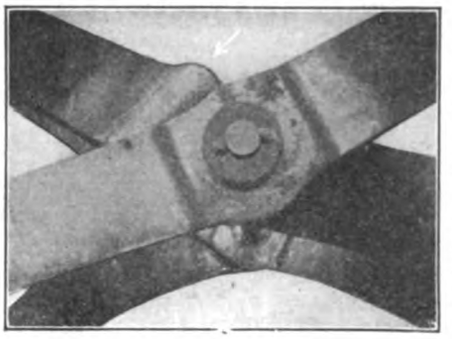


FIG. 3.

through and between the broken parts, a number of holes were drilled in the crack. A sheet iron mold box was first closely fitted to the arm and carefully lined with sand-and-flour core mixture and thoroughly baked. After the mold was placed in position, the parts were heated by means of a blow torch to expel all the moisture and to avoid chilling the thermit steel.

Fig. 2 is a photograph taken when the thermit reaction, or combustion, in the crucible was at its height. It also shows the mold in position. Ordinarily, only thirty or forty seconds from the moment of ignition are required to complete the combustion and produce the thermit steel. As soon as the ebullition ceases, the liquid steel settles to the bottom and the slag rises to the surface. The crucible is tapped from the bottom by forcing up the iron tapping pin and washer, which are instantly fused.

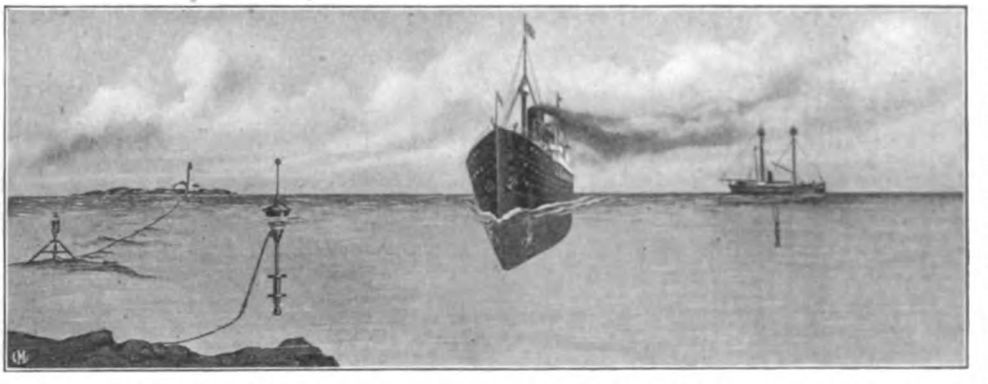
The thermit reaction creates a temperature of approximately 5,400° Fahr., so that, as in this instance, it is possible to add to the contents of the crucible a considerable percentage of steel punchings or rivets, which somewhat lowers the temperature and increases the quantity of liquid steel. Two hundred and fifty pounds of thermit were used (yielding after combustion 125 lbs. of liquid steel and 125 lbs. of slag) and forty pounds of small steel rivets.

Fig. 3 shows the bucket arms assembled after the repair was completed and the characteristic reinforcing collar of thermit steel cast around the weld for extra strength. Anticipating the question which naturally arises as to strength and permanency of thermit welds, tests have been very recently made at the works of the Fore River Ship Building Co., Quincy, Mass., covering this point. Bars of rolled steel 2 in. by 4½ in. were drilled, broken and welded with thermit, and standard test bars cut from the center of the weld. As a basis of comparison, test bars were also cut from the unwelded portions of the stock.

The following is a condensed report of the results obtained:

Descriptions.	Elastic limits.	Tensile strength
Weld	32,000	50,000
Stock	38,500	60,500
Weld	33,700	61,800
Stock	36,850	63,400

The American Ship Windlass Co., Providence, R. I., have just furnished another towing machine to parties in Russia who have already had three of these machines. It has also furnished two of its double drum hoisting engines to parties in Norway and has just shipped to England four of its sheet holders that are handling the sheets on a racing yacht. The company furnished the windlass which was placed on the German emperor's yacht Meteor. This windlass was made entirely of bronze and was highly polished. The yacht Atlantic, which won the ocean race last season, has twelve of the company's machines—one windlass, seven sheet holders and four winches.



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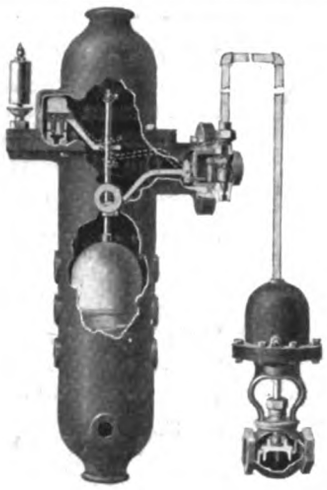

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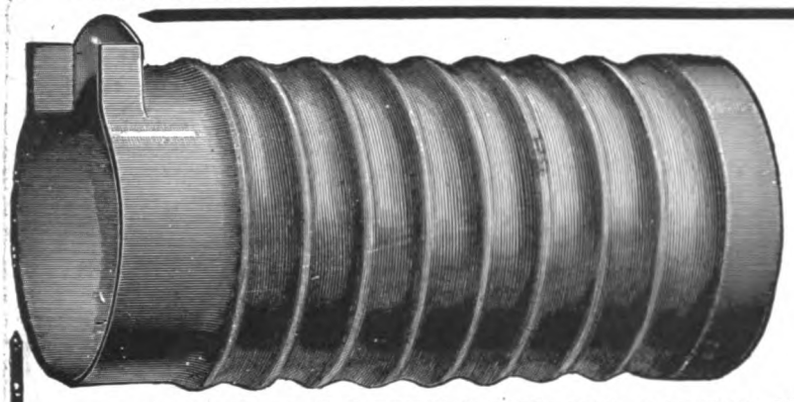

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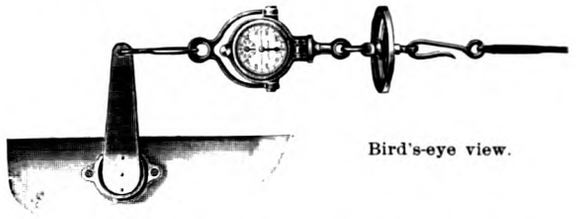

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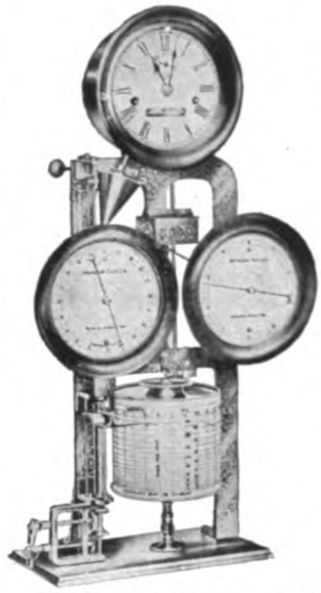

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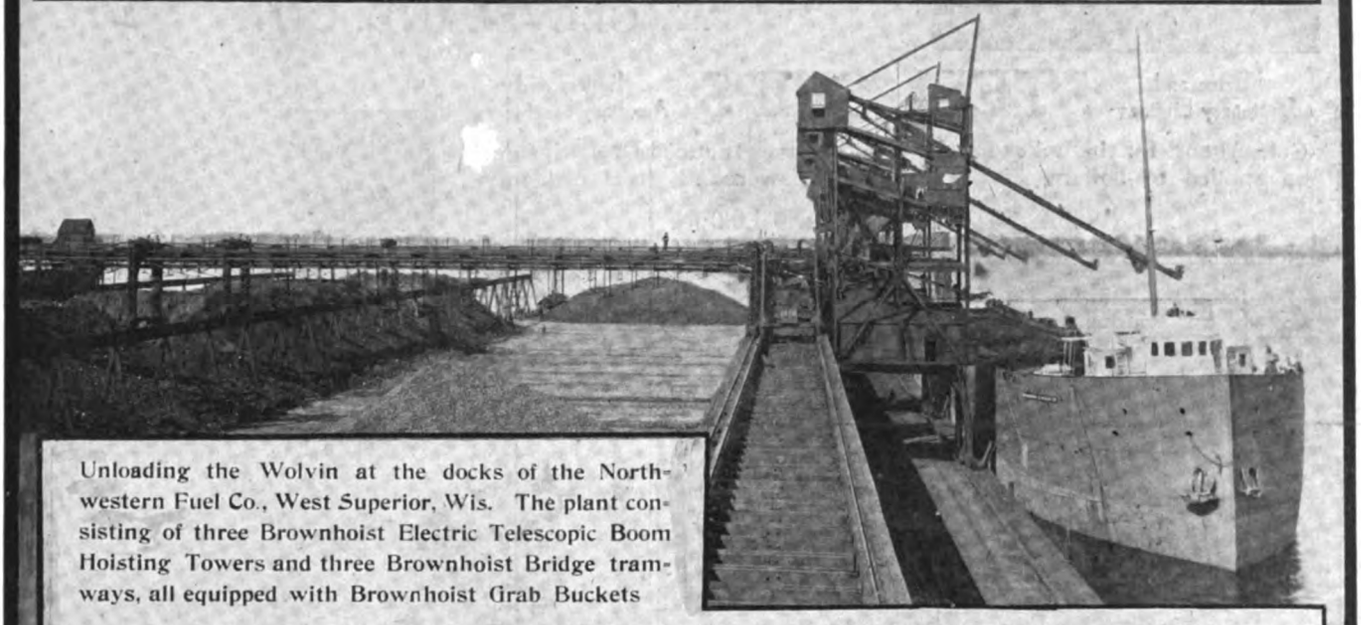

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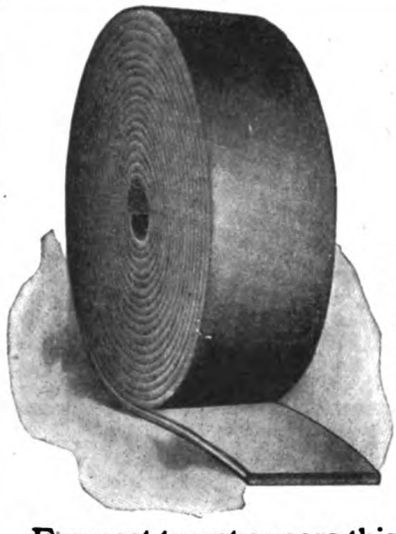

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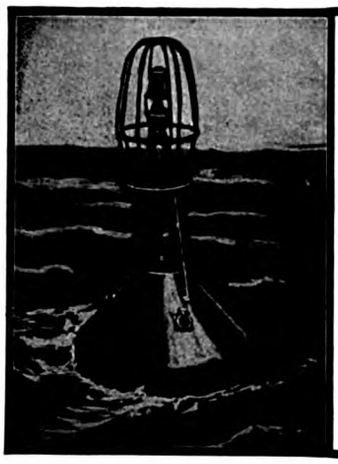

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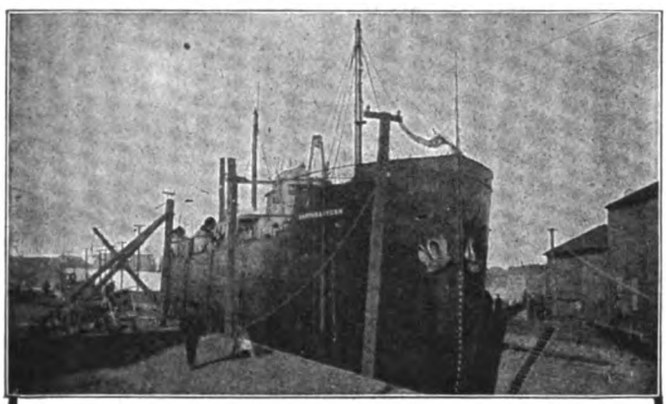

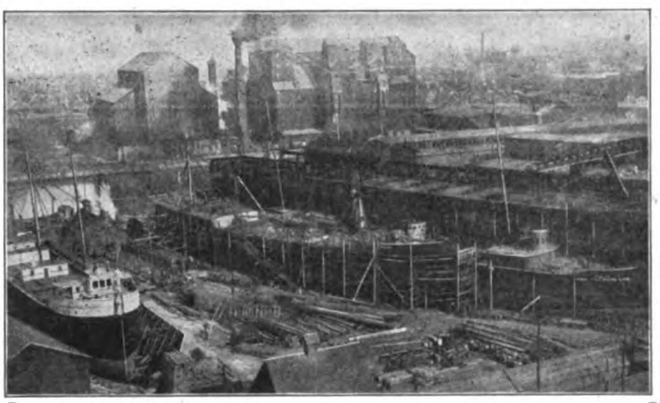

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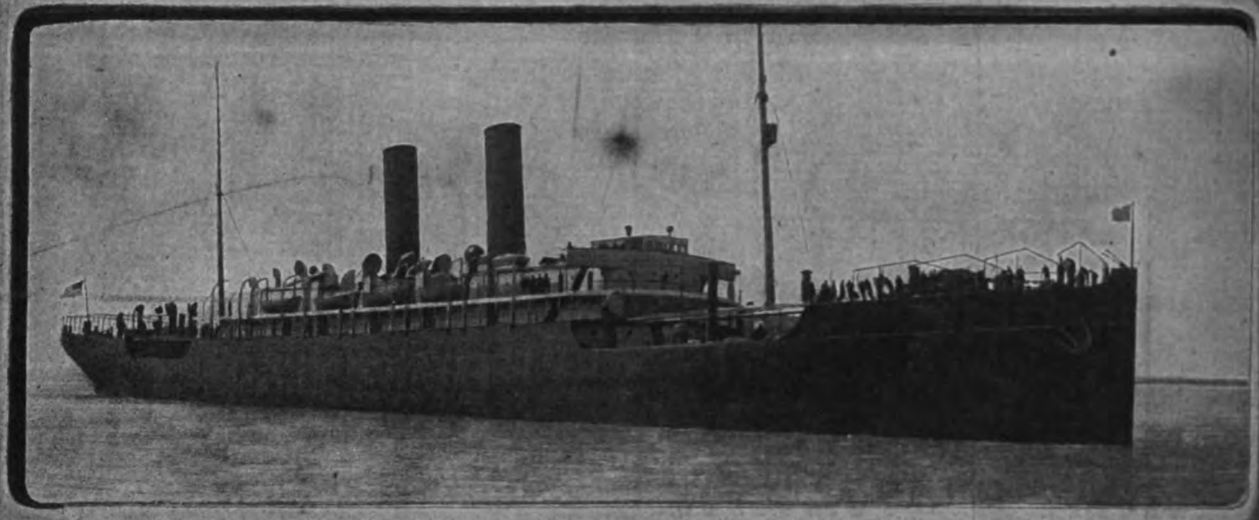

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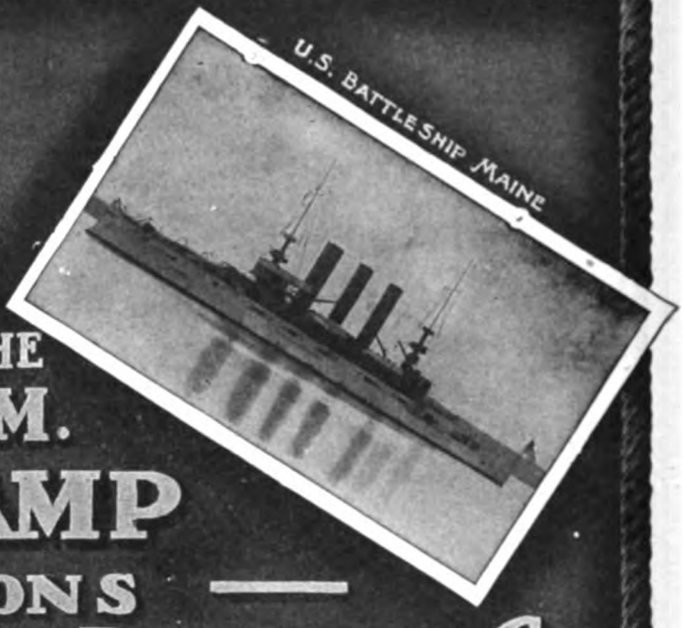

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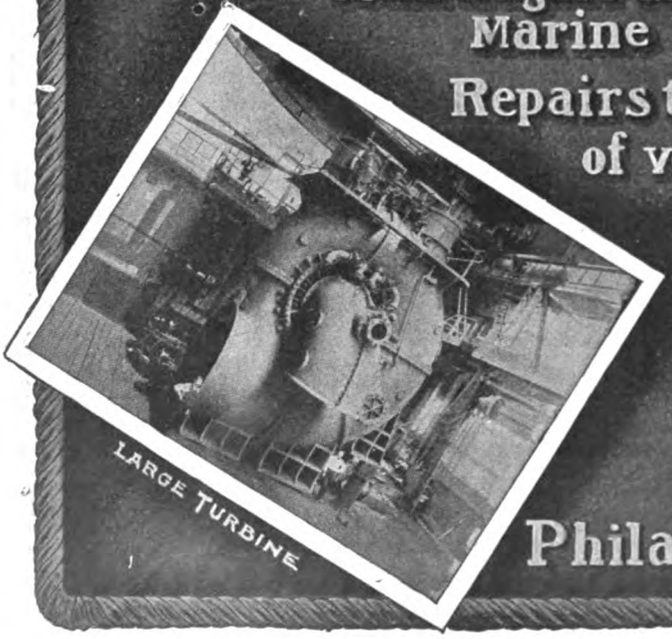

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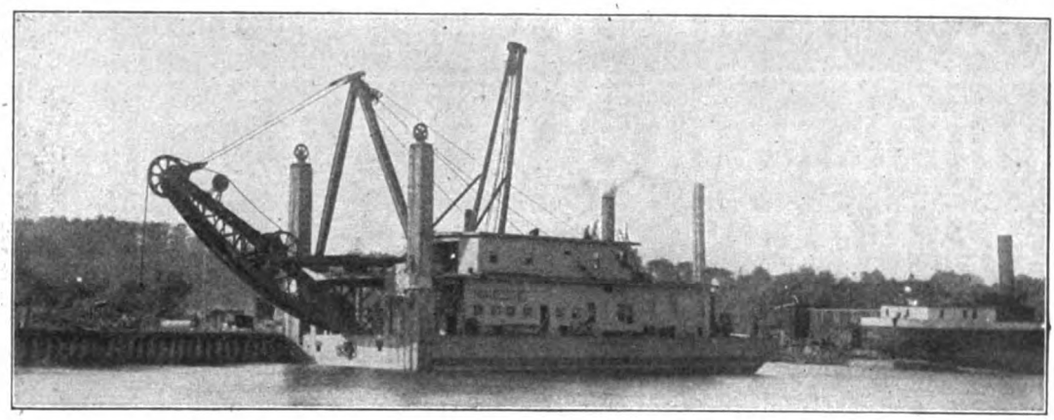

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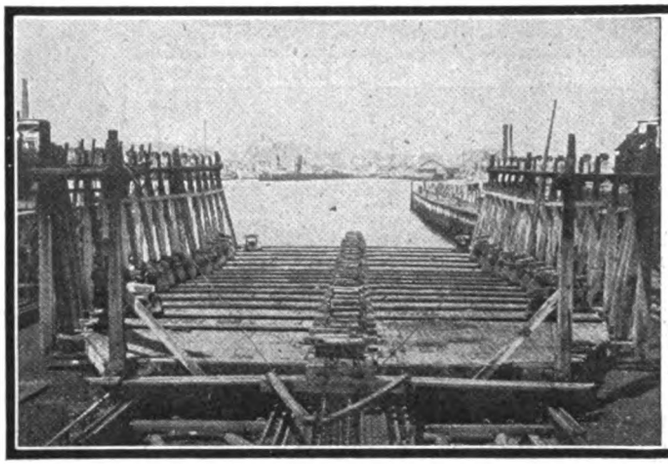

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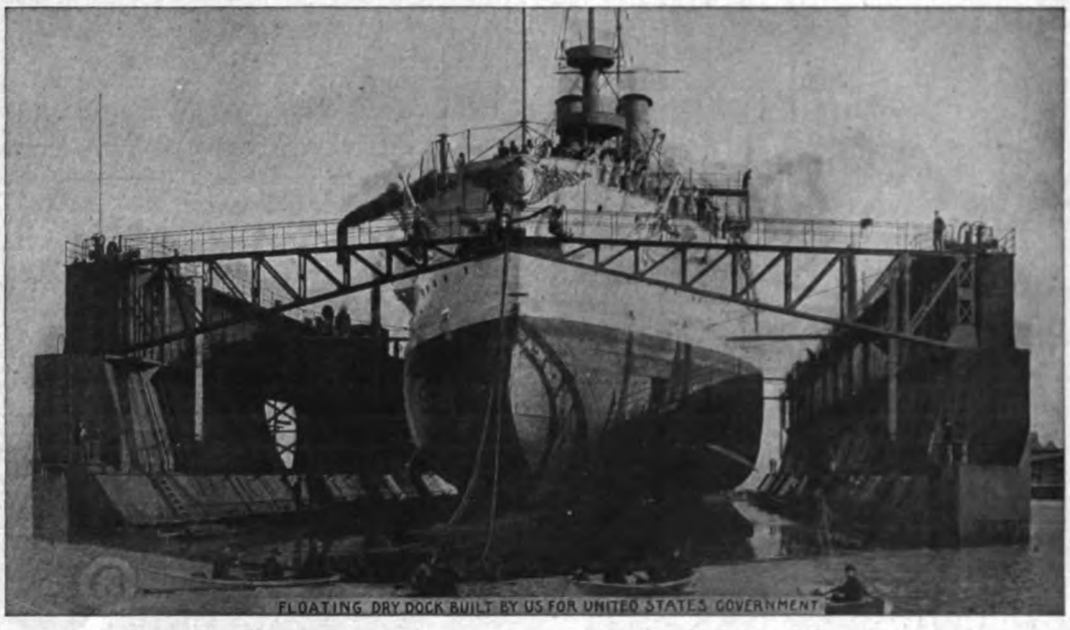

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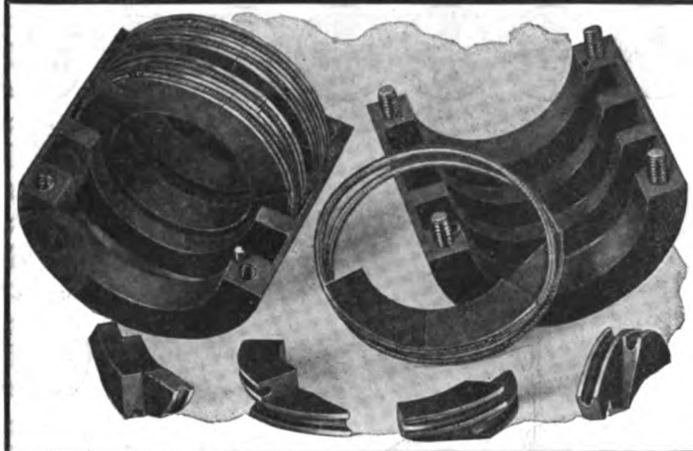

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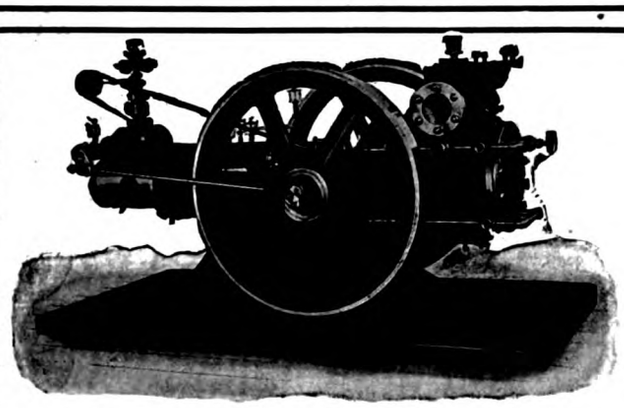

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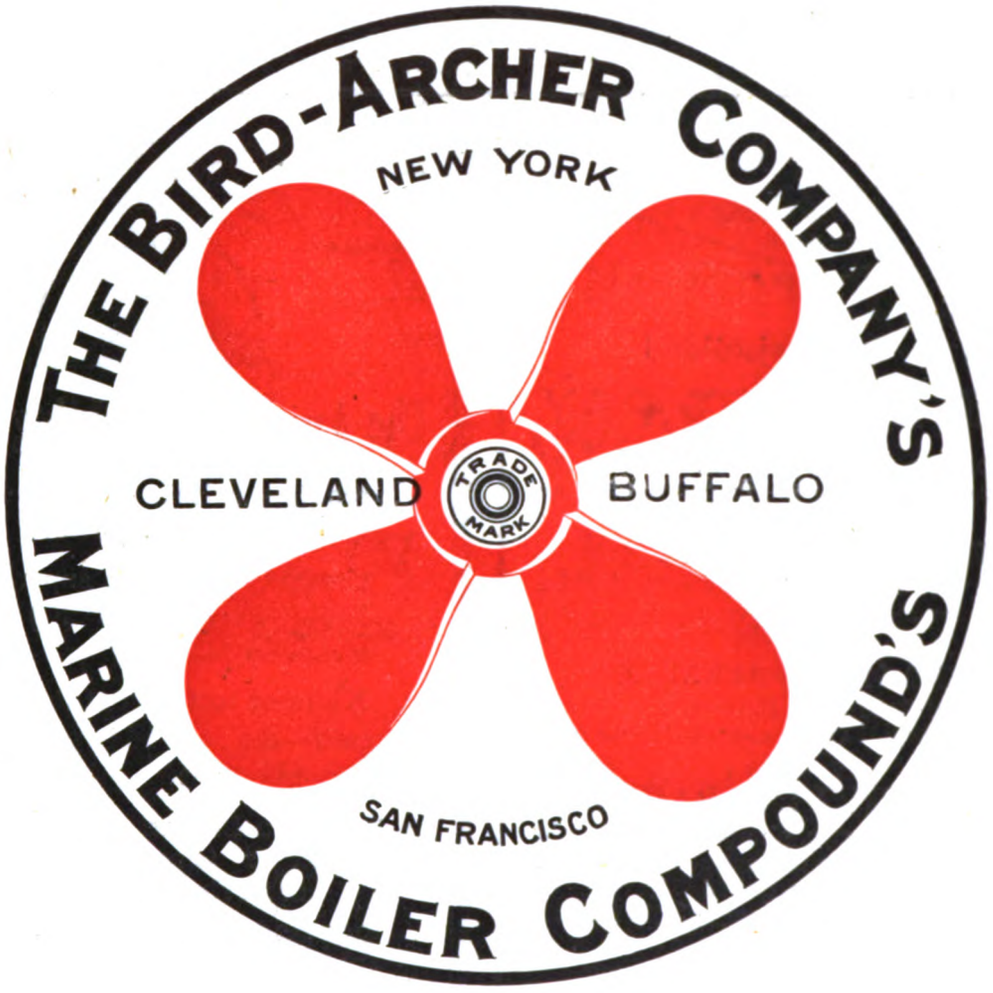

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AND DO AWAY WITH THE NECESSITY OF USING ZINCS

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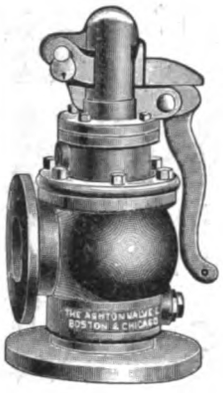

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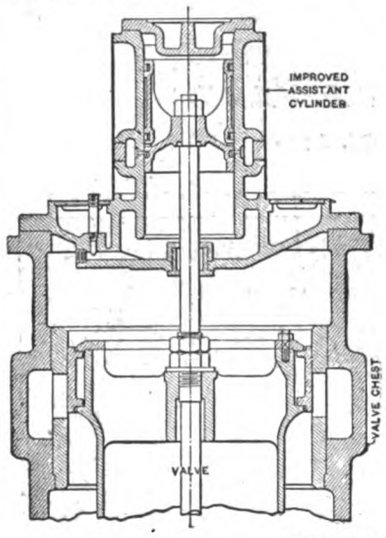
The Lovekin Improved Assistant Cylinder for Valve Gears (Patented)

NOTE!! See papers read before American Society of Naval Architects and Marine Engineers, Nov., 1902. Prize awarded for this article. Also see "Journal of the American Society of Naval Engineers," Vol. XVI. No. 3.



NOTHING experimental—simply a well-known principle applied in such a manner as to render impossible all doubts of its **successful working.**

No engine builder or designer would consider for a moment the running of a reciprocating engine without having first made **provision for proper compression at the top and bottom of the stroke.** Why, then, should not a valve gear receive its proper consideration, **and thus save the engineer many worries at sea?**

The saving of oil alone in all cases would warrant its general adoption, without mentioning expensive repairs, such as relining the Eccentric Sheaves with white metal, etc., something that **always occurs with the use of all other balance cylinders.** Summing it up briefly, it is as follows:—

1. **A money-saver to the steamship owner**
2. **A labour-saver to the engine-room force**
3. **A guarantee of the valve gear working perfectly**

Can be applied to any engine, old or new, without difficulty. In use at present time on engines aggregating over 130,000 I.H.P., among which are the following:—

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TEXAN, of the American Hawaiian Steamship Company
MASSACHUSETTS, of the Atlantic Transport Steamship Company
MISSISSIPPI, of the Atlantic Transport Steamship Company
LARIMER, of the Guffey Petroleum Company
LIGONIER, of the Guffey Petroleum Company
MONGOLIA, of the Pacific Mail Steamship Company
MANCHURIA, of the Pacific Mail Steamship Company
ONTARIO, of the Merchants' and Miners' Transportation Company

Approved for and being fitted to:—

U.S. Armoured Cruiser WASHINGTON, 25,000 I.H.P.
U.S. Battleship KANSAS, 18,000 I.H.P.
U.S. Battleship NEW HAMPSHIRE, 18,000 I.H.P.

☞ *The Steamship TEXAN has run over 100,000 miles without ever having to take a single liner out or to put one in the valve gear during all this time. This shows that friction and wear and tear have been almost eliminated.*

Address all communications to **Reference Furnished if Desired, and Prices Upon Application** *Agents Wanted for the Great Lakes*

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Sign on order for a U. S. Injector and you sign a "Declaration of Independence" from Injector troubles.

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American Injector Co.
Detroit, U. S. A.

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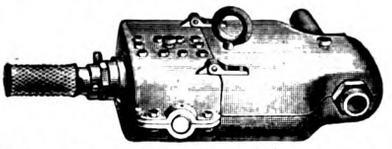
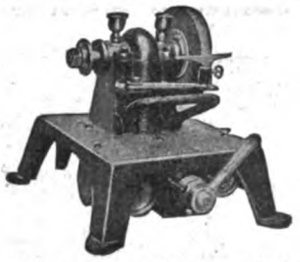
Reversible Pneumatic Motor



for drilling, tapping, reaming and expanding flues. With it you can drill close to corner or wall and in confined places. It has hinged cover readily raised for oiling and inspection.

Portable Pneumatic Grinder



Equipped with emery wheel, weighs 50 lbs., can be carried to place most convenient to work, avoiding necessity of going to stationary grinder.

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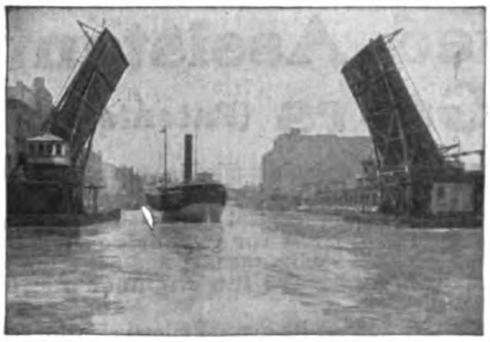

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have already been built, superseding and replacing swing bridges and other old types of movable bridges for railroads, electric railways and highways in the most progressive cities and harbors of the world.

HIGHEST AWARD

World's Fair, St. Louis, 1904

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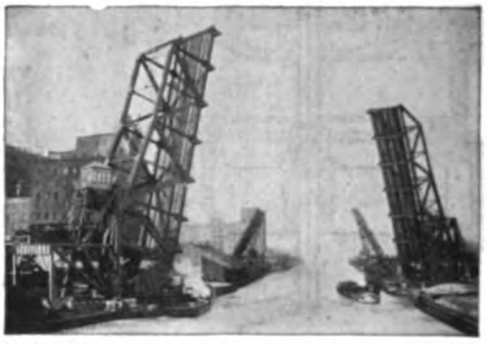

Modern Railroad Scherzer Rolling Lift Bridge in the open position. Longest span Bascule Bridge in the world. Also Highway Scherzer Rolling Lift Bridge open further down the river.

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8 SIZES, 11 STYLES

The new book *Shipmates* surpasses any caboose range literature we have ever before seen.

It has more than 60 illustrations, most of them of vessels of many varieties, all of which have been furnished Shipmate Ranges. If the subject of galley equipment is up for your attention, let us send you a copy, free.

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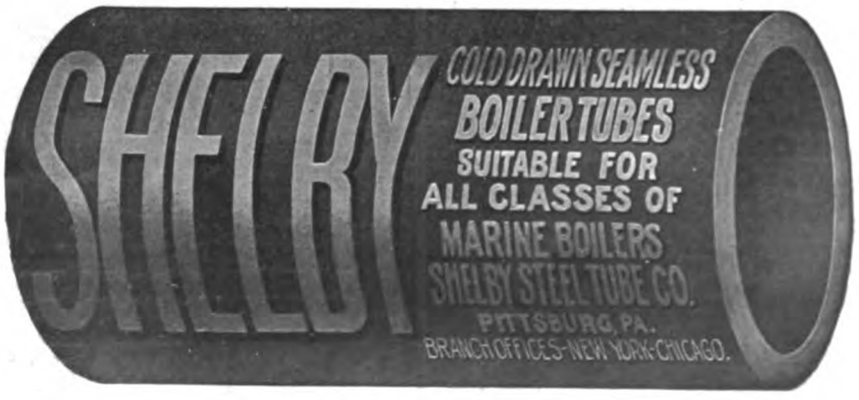

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METALLIC LIFE BOATS.

Every Time a Man Doesn't Say Anything He Lessens His Chances of Being Called a Fool.

But we believe a brief statement of facts eliminates the chances.

At practically the same price per person allowed, we can furnish a **Raft** that will save **75**% in deck space, **50**% in weight, and **90**% in cost of maintenance.

Our standard sizes range from 6 to 55 persons. Tested to comply with the **1906 Steamboat Rules and Regulations.**

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CARLEY LIFE FLOAT COMPANY,

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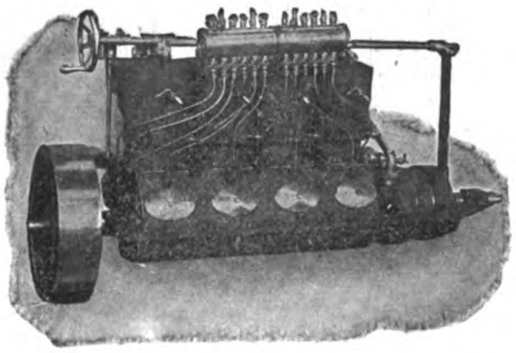
THE DEPENDABLE MARINE MOTOR



Made to withstand the most severe and continuous service. A practical design characterized by the accessibility, compactness and simple ignition, gas producing and oiling features. Perfect control.

Four cycle type two and four cylinders, from 8 to 65 H. P. Smaller sizes of the two cycle type.

Catalogue and copy of The Launch for the asking.

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"RAINO"

For Hard Service

"Raino" is a guaranteed absolutely waterproof cloth.

For ships' officers, yachtsmen, seamen, etc., it is the ideal waterproof garment.

"Raino" is very light, clean and neat looking. Far superior to either oilskins or rubber. It will not rot, nor is it stiff, heavy, oily or foul smelling.

After two years of the hardest kind of army and naval service tests in all parts of the world hundreds of officers declare it the most durable waterproof garment made.

"Raino" officer's Long Coat	**$6.00**
"Raino" Medium Coat	**5.00**
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"Raino" Overalls	**2.25**
"Raino" Soft Squam Hat	**1.00**

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(Makers of the famous Armstrong Uniforms.)

Write for prices on Uniforms.

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A week's trial, Rain, Hose or Shower. If not satisfactory express back a our expense. Money returned. Show our faith.

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The cutters are always in direct contact with the metal.
They will override any imperfections in the tubes, such as blisters, welds, etc.

Knives are always sharp, and because of their arrangement, their tendency is to work deeper all the time.

Heads or ends are made of drop-forged steel.

No screws or rivets used in its construction----yet it is the strongest cleaner made.

We control the outpout of this Flue Cleaner, and are the exclusive selling agents.

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Chicago, Ill.

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DETROIT, MICHIGAN.

ANTONIO C. PESSANO, President and Gen. Mgr.

GEORGE H. RUSSEL, Vice President.

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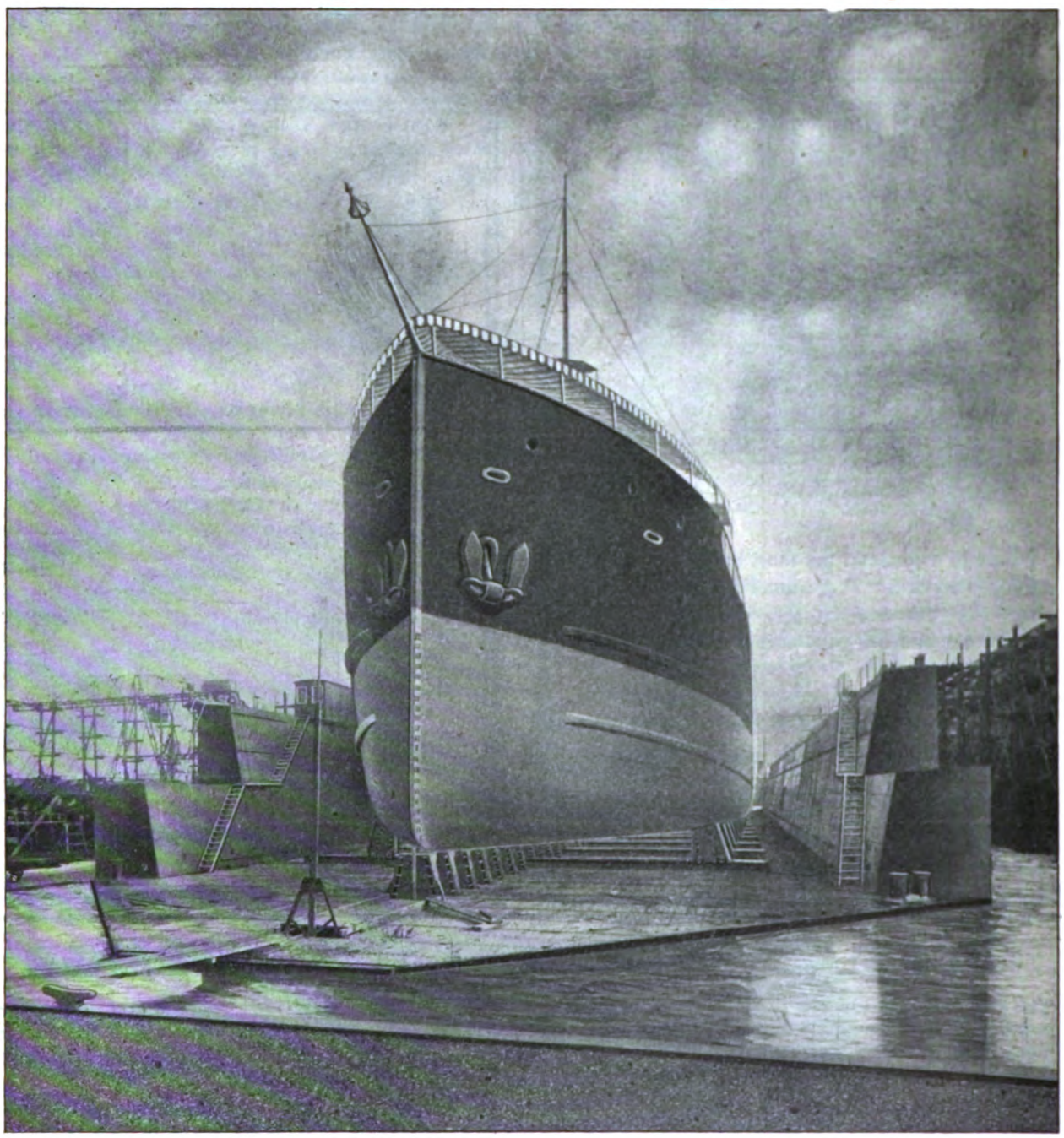
Designers and Builders of Steel Freight and Passenger Ships.



—STEEL FLOATING DRY DOCK—

Our Floating Steel Dry Dock is equipped with powerful Pumping Machinery and Appurtenances and has capacity for docking boats 600 feet long. The advantages of our dock permit of repairs being made **Expeditiously** and **Economically.**

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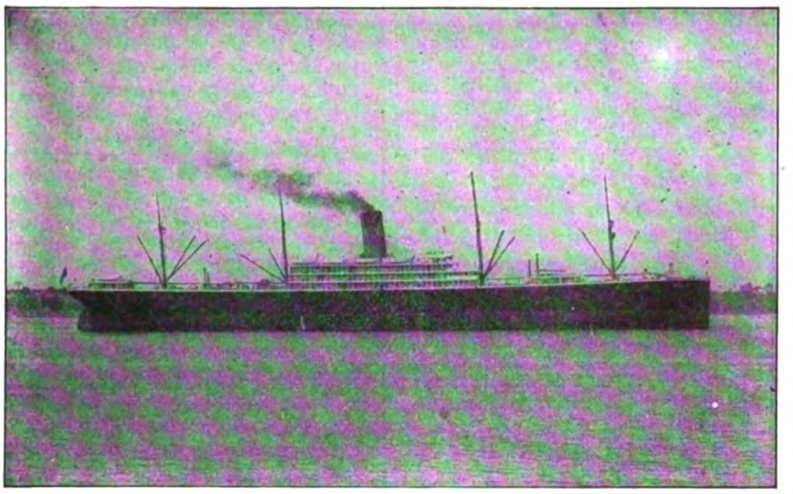
Hyde Windlasses and Capstans



Steamship Minnesota equipped with Hyde Windlass and Capstans.

Selected for the Minnesota and Dakota of the Great Northern Steamship Co.'s fleet—the largest vessels ever built in the United States. They are also being installed on nearly all of the vessels now building for the Navy Department, Revenue Cutter service, Lighthouse Board and the United States Coast Survey.

Reason—Their Superiority

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Life Saving
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Repairs and Construction.
Salvage
Submarine
General Illumination.

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BALTIMORE, MD.

Especially approved by The British Board of Trade, either of Life Buoy Lights or Deck Flare.

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WANTED and FOR SALE Department.

PROPOSALS.

U. S. Engineer Office, Milwaukee, Wis., June 28, 1906. Sealed proposals for removing old piers and building pile piers, Manitowoc Harbor, Wis., will be received here until 3 P. M. standard time, July 30, 1906, and then publicly opened. Information furnished on application. W. V. Judson, Major, Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., June 4, 1906. Sealed proposals for widening St. Marys' Falls Canal will be received at this office until 2 p. m., July 24, 1906, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col. Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., June 11, 1906. Sealed proposals for dredging Shoal 28 in Mud Lake, St. Mary's River, Mich., will be received at this office until 2 p. m. July 11, 1906, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col. Engineers.

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1,000 h. p. fore and aft Neafie & Levy compound Engine; surface condenser; independent pumps.
Two 12-foot Scotch Boilers.
One 13½-foot Scotch Boiler.
One 10 16-25 x 16 triple expansion Engine.
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One 200-h. p. Tregurtha Boiler.
One 14 30 x 24 fore and aft Engine and condenser.
One Williamson steering Engine.
One 10 k. w. electric lighting Set.
One 15 k. w. electric lighting Set.
One Providence Windlass, 50 fathoms 1½ in. chain.
Two thrust Shafts and Bearings, 8½ in. diameter.

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Steamer T. S. Christie.

Length 160 ft.; beam 30 ft.; carrying capacity, lumber 525,000 ft., coal 800 tons. Rating in Inland Lloyds Register, A1½*, valuation $22,000. For price and particulars address Capt. P. Larsen, care Francis Beidler & Co., Loomis & 22nd Sts., Chicago, Ill.

A Bargain.

Steamer E. F. Gould, length 137 ft., width 28 ft, depth 8 ft. 5 in, tonnage 261 tons. Boiler, engine and hull in good condition. First-class, complete sand pumping outfit now installed on boat, will sell with boat if so desired. Apply

JOHN M. McKERCHEY,
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Steamer T. S. Christie.

Length 160 ft.; beam 30 ft.; carrying capacity, lumber 525,000 ft., coal 800 tons. Rating in Inland Lloyds Register, A-1½*, valuation $22,000. For price and particulars address Capt. P. Larsen, care Francis Beidler & Co., Loomis & 22nd Sts., Chicago, Ill.

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on page 57 this issue.

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Marine Water Tube Boilers

Generators of the Highest Quality of Steam

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and all kinds of Machinery.

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[See accompanying Index of Advertisers for full addresses of concerns in this Directory]

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Great Lakes Engineering Works.... ....Detroit.

AIR PORTS, DEAD LIGHTS, ETC.
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Detroit Ship Building Co....Detroit.
Great Lakes Engineering Works.... .... Detroit.

ASH EJECTORS.
Great Lakes Engineering Works.... .... Detroit.

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Goulder, Holding & Masten..... .... Cleveland.
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Jenkins, Russell & Eichelberger.... ....Cleveland.
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MacDonald, Ray G.....Chicago.
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White, Johnson, McCaslin & Cannon ....Cleveland.

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Republic Belting & Supply Co..... ..... Cleveland.

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The Bird-Archer Co.....New York
Dearborn Drug & Chemical Works.. ....Chicago.
State Manufacturing Co...Cleveland.

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Almy Water Tube Boiler Co..... .....Providence, R. I.

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Great Lakes Engineering Works.. .... Detroit.
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Hyde Windlass Co.....Bath, Me.
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Great Lakes Engineering Works.... .... Detroit.
Thropp & Sons Co., John E..... ..... Trenton, N. J.
Wheeler Condenser & Engineering Co..... New York.

CONTRACTORS FOR PUBLIC WORKS.
Breymann Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.... ....Buffalo.
Graves & Stephens .....Cleveland.
Great Lakes Dredge & Dock Co.... .... Chicago.
Hickler Bros..... ....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H... .... Milwaukee.
Standard Contracting Co..Cleveland.
Sullivan, M..... Detroit.

CORDAGE.
Baker & Co., H. H.....Buffalo.
Upson-Walton Co.....Cleveland.

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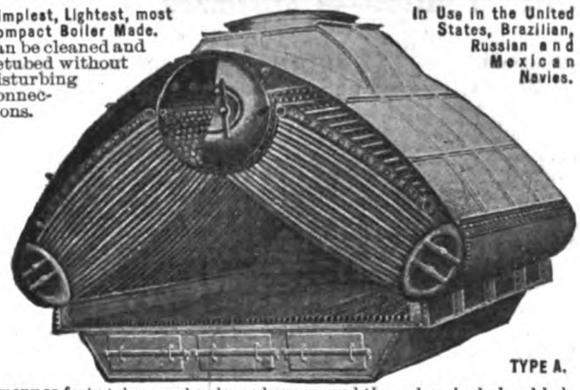
THE MOSHER PATENT WATER TUBE BOILER

Simplest, Lightest, most Compact Boiler Made. can be cleaned and retubed without disturbing connections.

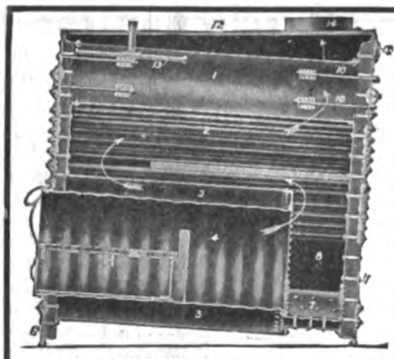
In Use in the United States, Brazilian, Russian and Mexican Navies.



TYPE A.

As many as forty tubes can be cleaned or renewed through a single hand-hole; has greater steam and water capacity than any other water tube boiler. Send for descriptive catalogue.

MOSHER WATER TUBE BOILER CO., NO. 1 BROADWAY, N. Y.



Detroit Scotch Water Tube Boiler

Internally Fired.

Scotch and Water Tube types combined, eliminating all objections.

Half the weight of ordinary Scotch boilers.

Standard corrugated furnaces.

Patent applied for. Investigate before buying any other.

EAST END BOILER WORKS

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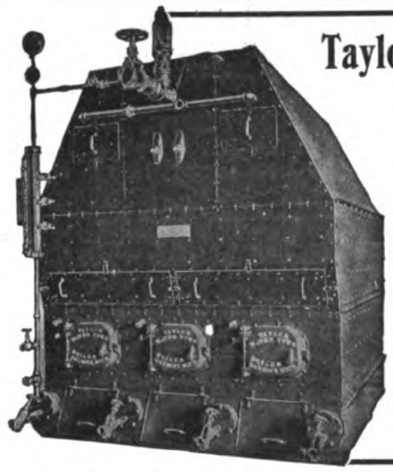

Taylor Water Tube Boiler Co.

Vertical Tubes, sectional, large steam space and liberating area.
Fire box, combustion chamber, and course for the furnace gases similar to the Scotch Marine.
Free circulation type.

Send for full description.

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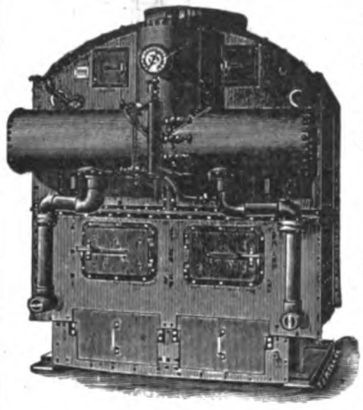
DETROIT, MICH



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ALMY'S PATENT SECTIONAL Water Tube Boilers

Bear Evidence of Their

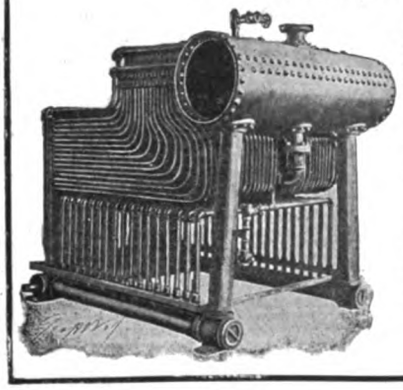
Excellent Qualities

ALMY WATER-TUBE BOILER CO.

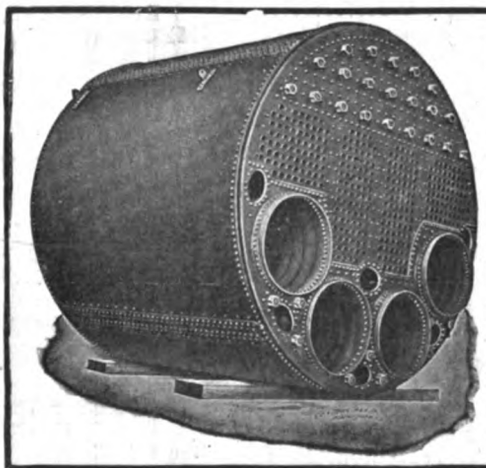
PROVIDENCE, R. I.

John E. Thropp & Sons Co.

TRENTON, N. J.



Builders of the Boyer Sectional Water Tube Boiler. Single, Compound and Triple Expansion Engines. Machinery complete for light draft Passenger Boats, Yachts, Tugs.



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OF ALL TYPES

KINGSFORD FOUNDRY & MACHINE WORKS,

Oswego, N.Y.

LATEST PATENT ANCHOR

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APPROVED BY LLOYDS.

Manufactured by

L. M. BOWERS & CO.,

Binghamton, N. Y.

Catalogue on Application.

The National and International

ANCHORS.

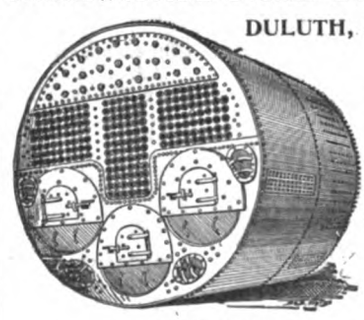
Furnished to the Lake Trade by

The Upson-Walton Co.,

CLEVELAND, O.

Northwestern Steam Boiler & Mfg. Co.

DULUTH, MINN.



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J. H. OPPERMAN, *Secretary*, 579-R; E. KRIZ, *Superintendent*, 557-M.

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CORK JACKETS AND RINGS.
Armstrong Cork Co..Pittsburg, Pa.
Kahnweiler's Sons, D....New York.

CRANES, TRAVELING.
Brown-Hoisting Machinery Co.....
.... Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son.....Boston.
Schrader's Son, Inc., A..New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....
.... Buffalo.
Great Lakes Dredge & Dock Co..
.... Chicago.
Hickler Bros. .....
.....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H...
....Milwaukee.
Sullivan, M..... Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co.New York.

DRY DOCKS.
American Ship Building Co.....
.... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....
.... Chicago
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co.....
.... Detroit
Great Lakes Engineering Works....
.... Detroit.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Milwaukee Dry Dock Co.....
....Milwaukee.
Newport News Ship Building Co...
.....Newport News, Va.
Shipowners' Dry Dock Co.Chicago.
Superior Ship Building Co.....
.... Superior, Wis.
Tietjen & Lang Dry Dock Co.....
..... Hoboken, N. J.
Toledo Ship Building Co.....Toledo.

DREDGE BUILDERS.
Manitowoc Dry Dock Co.....
..... Manitowoc, Wis.

DYNAMOS.
General Electric Co.....
....Schenectady, N. Y.
Thropp & Sons, John E.....
....Trenton, N. J.

ELECTRIC HOISTS AND CRANES.
General Electric Co.....
.....Schenectady, N. Y.

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co.....
.....Schenectady, N. Y.
Thropp & Sons, John E.....
.....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co.....
..... Cleveland.
Atlantic Works, East Boston, Mass.
Chicago Ship Building Co., Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons, Philadelphia.
Detroit Ship Building Co., Detroit.
Fletcher, W. & A. Co., Hoboken, N. J.
Fore River Shipbuilding Co.....
..... Quincy, Mass.

ENGINE BUILDERS—Continued.
Great Lakes Engineering Works....
..... Detroit, Mich.
Hall Bros. ..... Philadelphia.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Maryland Steel Co.....
.....Sparrows Point, Md.
Milwaukee Dry Dock Co., Milwaukee.
Mosher, Chas. D.....New York.
Newport News Ship Building Co....
.....Newport News, Va.
New York Ship Building Co.....
.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Mich.
Quintard Iron Works Co., New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....
..... Superior, Wis.
Thropp, J. E. & Sons Co.....
.....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co., New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Lunkenheimer Co. ..... Cincinnati.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander ..... Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James ..... Cleveland.
Roelker, H. B.....New York.
Wood, W. J.....Chicago.

FEED WATER PURIFIERS AND HEATERS.
Ross Valve Co.....Troy, N. Y.
Wheeler Condenser & Engineering Co. ..... New York.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co....
..... Cleveland.
Fore River Shipbuilding Co.....
..... Quincy, Mass.

FLUE WELDING.
Fix's S. Sons.....Cleveland.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co., Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co., Detroit.

FURNACES FOR BOILERS.
Continental Iron Works, New York.

GAS BUOYS.
Safety Car Heating & Lighting Co..
..... New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.

GAUGES, STEAM AND VACUUM.
Lunkenheimer Co. ..... Cincinnati.

GAUGES, WATER.
Lunkenheimer Co.....Cincinnati, O.

GENERATING SETS.
General Electric Co.....
.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

HAMMERS, STEAM.
Chase Machine Co.....Cleveland.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....
..... Cleveland
Brown Hoisting Machinery Co.....
..... Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
General Electric Co.....New York.
Hyde Windlass Co.....Bath, Me.
Marine Iron Co.....Bay City.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co.....
.....Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works....
.... Detroit.

HYDRAULIC TOOLS.
Watson Stillman Co, The.....
..... New York

ICE MACHINERY.
Great Lakes Engineering Works....
..... Detroit.
Roelker, H. B.....New York

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros.....New York.
Lunkenheimer Co. ..... Cincinnati.
Penberthy Injector Co.....
..... Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co.....Chicago
Gilchrist & Co., C. P.....Cleveland
Hawgood & Co., W. A., Cleveland.
Helm & Co., D. T.....Duluth
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F.....
.....New York and Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

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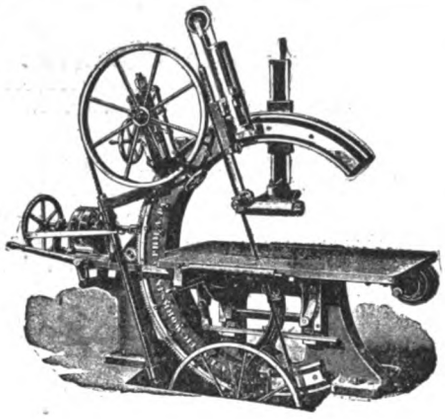
Successors to Berry & Orton Company
Manufacturers of

Machinery for Working Wood
also Band Saw Blades

For use in Ship Yards, Car Shops, Railroad Shops.
Estimates furnished. Send for Catalogue.

2870-72-74-76-78 Gray's Ferry Road
Philadelphia, Pa.



Adjustable Bevel Band Saw

will bevel both ways at 45 degrees

Power movement to change angles

Power feed in three directions

G

Wrecking Steamer FAVORITE

Located at St. Ignace this Year.

The Wrecking Steamer FAVORITE, Alex. Cunning, Master, will be stationed during season 1906 at ST. IGNACE, MICH. A Long-Distance Telephone has been installed on board the steamer. When at her home dock, the steamer can be reached by telephone any time day or night, 'Phone Number 63, and in absence of steamer full information as to the steamer may be obtained by telephoning to residence of Capt. Cunning, St. Ignace.

The Favorite and her equipment were thoroughly overhauled during the past winter, and are in first class condition to do outside work.

Smith's Coal Dock

DETROIT RIVER

DETROIT MICH.

12 Pockets. Platform.

Low Dock.

Operated by

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IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co., Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong Cork Co.....Pittsburg.
Carley Life Float Co.....New York, N. Y.
Drein, Thos. & Son..... Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson.....Buffalo.

LOGS.
Nicholson Ship Log Co., Cleveland.
Walker & Sons, Thomas..... Birmingham, Eng.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. ..... Cincinnati.

LUMBER.
Martin-Barriss Co. ..... Cleveland.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros., Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc....Philadelphia.

MARINE RAILWAYS.
Hickler Bros., Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co..... Cleveland.
Detroit Ship Building Co., Detroit.
Great Lakes Engineering Works.... Detroit.

METALLIC PACKING.
Katzenstein, L. & Co., New York.
The National Metallic Packing Co..

MOTORS, GENERATORS—ELECTRIC.
General Electric Co.....Schenectady, N. Y.

NAUTICAL INSTRUMENTS.
Ritchie, E. S., & Sons..... Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander .....Cleveland
Kidd, Joseph .....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland
Wood, W. J.....Chicago

OAKUM.
Stratford, Oakum Co.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

PACKING.
Jenkins Bros.....New York.
Katzenstein, L. & Co...New York.
Robertson, Jos. L. & Sons.....New York.
The National Metallic Packing Co... Oberlin, O.
Republic Belting & Supply Co.....Cleveland, O.

PAINTS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc. ..Philadelphia.

PILE DRIVING AND SUBMARINE WORK.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.... Buffalo.
Great Lakes Dredge & Dock Co.... Chicago.
Hickler Bros..Sault Ste. Marie, Mich.
Hubbell Co., H. W...Saginaw, Mich.
Parker Bros. Co., Ltd.....Detroit.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H... .....Milwaukee.
Sullivan, M.....Detroit.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc....Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.
Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

PRESSURE REGULATORS.
Ross Valve Co.....Troy, N. Y.

PROPELLER WHEELS.
American Ship Building Co..... Cleveland.
Atlantic Works ..East Boston, Mass.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co....Detroit.
Fore River Shipbuilding Co..... Quincy, Mass.
Great Lakes Engineering Works.... Detroit.
Hyde Windlass Co.....Bath, Me.
Lockwood Mfg. Co.....East Boston, Mass.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co.. .....Newport News, Va.
Roelker, H. B.....New York.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....Superior, Wis.
Thropp & Sons Co., J. E.....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.
General Electric Co.....Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.
Great Lakes Engineering Works.. ..... Detroit.
Kingsford Foundry & Machine Works .....Oswego, N. Y.
Wheeler Condenser & Engineering Co. .....New York.

RANGES.
Stamford Foundry Co.....Stamford, Conn.

REFRIGERATING APPARATUS.
Great Lakes Engineering Works.... ..... Detroit.
Roelker, H. B.....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RIVETS, STEEL FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland, O.

RUBBER SUPPLIES.
Republic Belting & Supply Co..... Cleveland, O.

SAFETY VALVES.
Lunkenheimer Co.....Cincinnati.

SAIL MAKERS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co.....Cleveland.

SALVAGE COMPANIES.
See Wrecking Companies.

SEARCH LIGHTS.
General Electric Co.....Schenectady, N. Y.

SHEARS.
See Punches, and Shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co..... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons..Philadelphia.
Chicago Ship Building Co..Chicago.
Detroit Ship Building Co....Detroit.
Fore River Ship Building Co..... ..Quincy, Mass.
Great Lakes Engineering Works.... .....Detroit.
Lockwood Mfg. Co.....East Boston, Mass.
Manitowoc Dry Dock Co.....Manitowoc, Wis.
Maryland Steel Co.....Sparrow's Point, Md.
Milwaukee Dry Dock Co..... Milwaukee.
Newport News Ship Building Co... .....Newport News, Va.
New York Shipbuilding Co.....Camden, N. J.
Roach's Ship Yard.....Chester, Pa.
Shipowner's Dry Dock Co..Chicago.
Toledo Ship Building Co.....Toledo.

SHIP CHANDLERS.
Baker, Howard H. & Co....Buffalo.
Marine Mfg. & Supply Co..... New York.
Upson-Walton Co.....Cleveland.

SHIP DESIGNERS.
Kidd, Joseph .....Duluth.
Steel, Nacey, & Hynd....Cleveland.
Wood, W. J.....Chicago.

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PUBLIC WORK CONTRACTORS

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Derrick Scows
Pile Drivers
Lighters
Concrete Plants

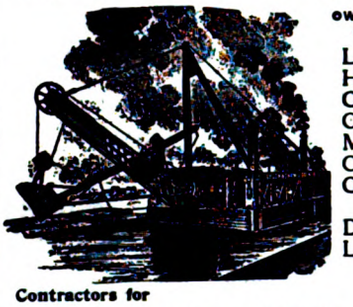
Commercial Bank Bldg. CLEVELAND, O.

Buffalo Dredging Co.

GENERAL CONTRACTORS
—ON—
SUBMARINE WORK

Office
D. S. Morgan Bldg. BUFFALO, N. Y.

GREAT LAKES DREDGE & DOCK CO.



OWNS AND OPERATES THE PLANTS OF THE FORMER COMPANIES:

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Hausler & Lutz Co.
Green's Dredging Co.
Chicago Star Con. & D. Co.
McMahon & Montgomery Co.
Chicago Dredging & Dock Co.
Griffith, McDermott & Watt Dredging Co.
Duluth Dredge & Dock Co.
Lake Superior Contracting & Dredging Co.

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RIVER AND HARBOR IMPROVEMENTS.
Main Office: 1319-1322 Chamber of Commerce - CHICAGO

DUNBAR & SULLIVAN DREDGING CO.
BUFFALO, N. Y.

Ready for Spring A New Tool

A REVOLVING CLAMSHELL DREDGE

which will do the following impossibilities to the ordinary dredge:

Excavate 60′ back from face of dock into scow or vice versa. Excavate at either end of itself and dump in scow at other end. This makes through cutting and cleaning narrow slips cheaply possible. Excavate trenches to 150′ or more depth. Excavate material and throw it one side 150′ from original site where there is four feet of water between dump and channel. Excavate shallow channels down to 4′ x 44′. Clean out boulders or obstructions without disturbing surrounding bottom. Excavate close to docks without injury to dock. Anything that ordinary derrick will do up to 10 tons at 75′ radius.

This is an excellent wrecking tool.

Hickler Brothers

SAULT STE. MARIE, MICH.

MARINE RAILWAY

Capacity, 1,000 tons. Draft, 7½ ft. forward, 13½ ft. aft. Length on keel blocks, 180 ft.; over all, 190 ft.

Machine Shop, Foundry and Steam Forge, Dredges, Drill Boats and Derrick Scows.

Steamboat Fuel at Ashtabula.

Large Supplies of Best Quality.

Lighter Carrying Different Grades at all Times.

Fuel Scow with elevators and discharging spouts. Storage of 800 tons. Discharges 250 tons an hour into steamers while unloading cargo.

M. A. Hanna & Co., *Miners and Shippers,*
Main Office, Perry-Payne Bldg., Cleveland.

H. W. HUBBELL CO.

Submarine Work
of all kinds

Dredging Hard Material a Specialty.

SAGINAW - - MICH.

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Upson-Walton Co..... Cleveland.

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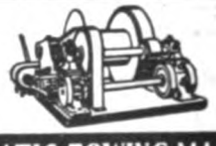

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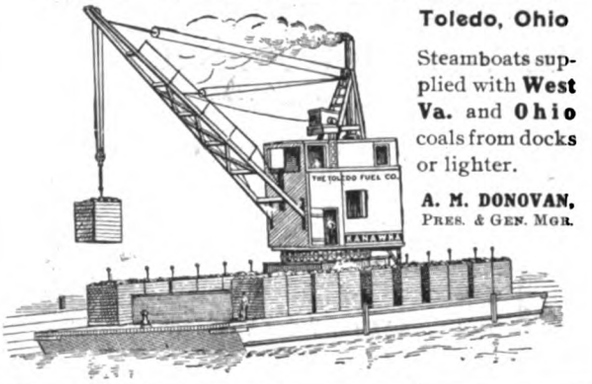

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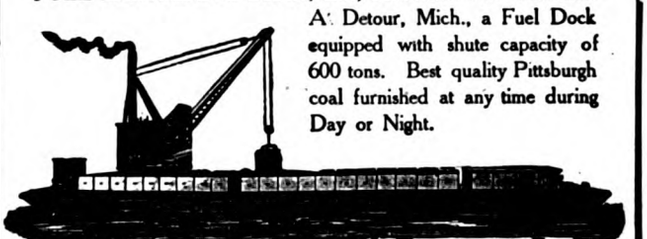

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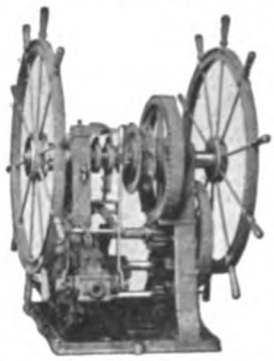

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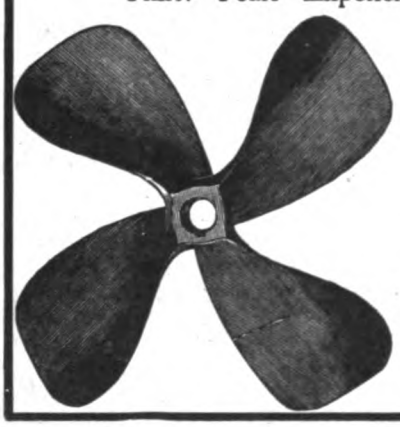

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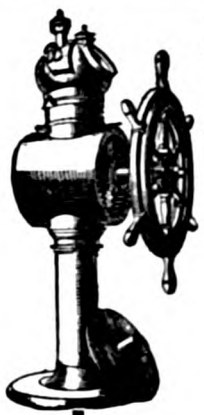

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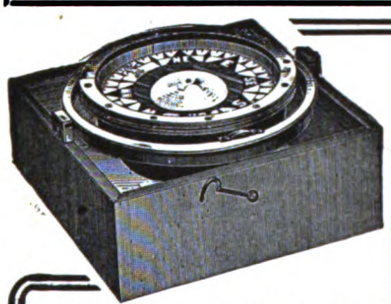

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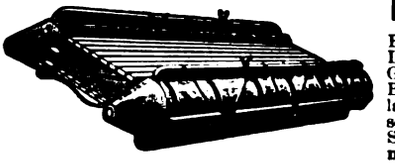

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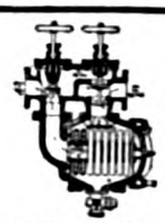

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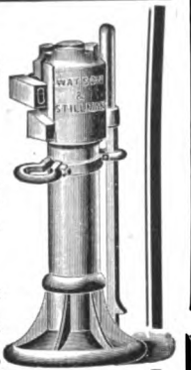

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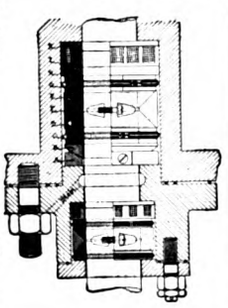

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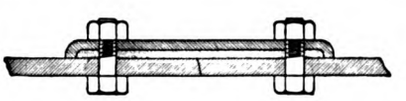

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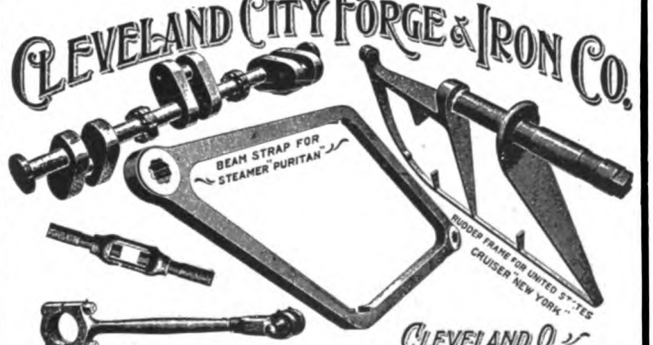

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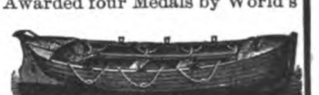

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